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"Journal" [Botanicheskii Zhurnal] and some of our scientists is discussed. Instead of criticizing one another and pointing out [existing] shortcomings in a business like, scientific manner, the affair took on an offensive tone and became humiliating." The reply of N.S. Khrushchev: "The staff must be looked over. Evidently, people who were selected as editors are against Michurin's science. As long as they remain there nothing will change. They must be replaced, others, real Michurinites, must be appointed. Therein lies the radical solution of the problem."² The wrong direction taken by the editorial board of the "Botanical Journal" [Botanicheskii Zhurnal] has been voiced in a number of articles. They do not bear the character of an occasional, isolated incident, but characterize a position that pursued the objective of censuring the fundamental propositions in the works of Academician Lysenko.

Let us dwell briefly upon certain problems of the Michurin direction in biology that have been subjected to criticism by the "Botanical Journal" [Botanicheskii Zhurnal].

Authors whose works appeared in the "Botanical Journal" paid a great deal of attention to the defense of chance as a decisive factor in evolution in defense of the fundamental thesis of

² Plenum of the Central Committee, Communist Party, Soviet Union, December 15-19. Stenographic record. State Publishing House of Political Literature. Moscow, 1958, p. 233

corpuscular genetics, concerning the fortuitous character of changes occurring in organisms. [Begin p. 11].

Number of the "Botanical Journal" [Botanicheskii Zhurnal] for 1956 includes an article by D.V. Lebedev in which the process of natural selection is attributed the role of a sieve while its creative role is denied, which in essence reduces to naught the basic proposition of Michurin's teaching concerning the unity of an organism and its habitat. In the same connection, in a series of articles, is negated one of the basic principles of Michurin's teaching concerning the possibility of inheritance of acquired characteristics.

Especially sharp are statements made on these grounds in an editorial¹ in which the efforts of the critics are concentrated on evidence that negates the principle of inheritance of acquired characteristics. The fundamental meaning of an analysis of the problem concerning the inheritance of acquired characteristics is reduced to a thesis of corpuscular genetics to the effect that they are not inheritable. The method used in the article [in an attempt] to produce evidence is a very peculiar one. Instead of discussing and analyzing the concrete facts available in the

¹ About some problems of Soviet biology. (On the occasion of T.D. Lysenko's article "For materialism in biology"). "Botanicheskii Zhurnal", no. 8, 1958.

literature, all of them are declared insolvent with one stroke of the pen on the basis that in all experiments that had been conducted and in data on this problem in the possession of scientists of different countries "the original genetic material had proved genetically heterogeneous" (p. 1141).

The editors obviously, considered this one phrase as sufficient to relieve themselves [of the job] of examining the available facts and of analyzing them.

Further, the editors noted that T.D. Lysenko and his followers had confused the problem of inheritance of acquired characteristics with the problem of the role of external environment as a factor of hereditary variation. It is fitting to say that the problem concerning inheritance of acquired characteristics cannot be stated differently than T.D. Lysenko had done it. In a negation of the directed character of the influence of external conditions upon variation and heredity, the article emphasizes the importance of only the mutagenic action of radiant energy. In other words, the authors of the article recognize as external conditions only the role of the accelerants of the mutation process occurring within the sexual cells without [vne] any relationship to the environment.

The editorial tried to strengthen its own viewpoint regarding the heredity of acquired properties by referring repeatedly to the opinions of a number of scientists of western Europe.

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After this, they indiscriminately negated all results of experiments conducted in vegetative hybridization as evidence of inheritance of acquired properties. These facts had already been subjected earlier to a similar negation in an article by A.R. Zhebrak² [published] in no. 3 of the year 1956, and in an article by Iu.M. Olenov³ in no. 7 of 1956. The possibility of a directed conversion of spring crops into winter crops and of winter crops into spring crops (article by V.V. Skripchinskii)⁴ and a series of other factors were also subjects of negation. [Begin p. 111].

The position of the Journal was completely wrong when it attempted to make of I.V. Michurin a supporter of formal genetic conceptions.¹

Everybody knows exactly what Michurin wrote concerning the laws of Mendel, and that I.V. Michurin gave theoretical substantiation to the principle of hereditary transmission of acquired characteristics.

In the editorial in the "Botanical Journal" [Botanicheskii Zhurnal] mentioned above, the position of a number of scientists

¹ A.R. Zhebrak. "Nature of grafting in higher plants". "Botanicheskii Zhurnal", no. 3, 1956.

² Iu.M. Olenov. Is the possibility of vegetative hybridization an argument against the role played by chromosomes in heredity. "Botanicheskii Zhurnal",

³ V.V. Skripchinskii. Once again about the transformation of winter cereals into spring cereals and spring cereals into winter ones in the light of C. Darwin's teaching. "Botanicheskii Zhurnal", no. 4, 1957.

⁴ I.K.M. Zavadskii. Scientific heritage of I.V. Michurin and some problems of biology. "Botanicheskii Zhurnal", no. 1, 1956.

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was treated entirely incorrectly as regards the evaluation of the role played by hormones and of stimulants in the life of plants. Physiologically active substances were not rejected, as the editors of the "Botanical Journal" [Botanicheskii Zhurnal] alleged, nor was the possibility and necessity of working with them; rejected was merely the non-materialistic interpretation made by many scientists of a study of physiologically active substances as special administrators of the processes occurring in the life of plants.

Criticism of Michurin's direction and attacks against the activities of Academician T.D. Lysenko reached their severest form in the tendentious editorial that appeared in no. 8 of the Journal for 1956.

The estimate of losses that individual Michurinist scientists and, in particular, Academician T.D. Lysenko had, allegedly, caused the State are completely inaccurate and unrealistic, which has been justly described in the editorial in the newspaper "Pravda".

In a series of articles published in the "Botanical Journal" [Botanicheskii Zhurnal], an enemy of the Soviet Union and a misanthrope, such as Dobzhanski, who even now advocates [ratuet]

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eugenics that are the basis of contemporary racism, has prop-
gandized himself as a genuine Darwinist.

At the Tenth International Congress on Genetics it became clear that criticism on the part of Michurinites of the basis of Morganist fundamentals - of the conception of a hereditary substance that, supposedly, directs all characteristics and properties of an organism, but does not yield to directed change by means of changed conditions of life, has begun to attract ever increasing attention among the more progressive scientists of the world (Professor Lindergren, Professor Sinoto and others). This fact was reflected in many reports [heard] at ^{the} Congress. In any case, by now it is obvious to all that Michurin's direction in genetics is not just a local Russian phenomenon in science. At the Congress, several reports were made by scientists from Switzerland, Japan, England and other countries, who by virtue of the brilliant examples of their own experiments demonstrated conclusively to what extent their approach to the study of hereditary phenomena had been enriched since they had acquainted themselves with Michurin's works and had begun to use these principles in their own investigation.²

² N.I. Muzhdin and Kh.F. Kushner. Tenth International Genetics Congress in Canada. "Izvestiia Akademii Nauk SSSR. Seriya Biologicheskaya", no. 2, 1959.

It is interesting to note that a special "Section of Vegetative Hybridization", one of those that had the largest number of visitors, was organized at ^{the} Tenth Congress on Genetics. [Begin p. IV].

All that has been stated above bears witness to the fact that the "Botanical Journal" [Botanicheskii Zhurnal] had by-passed these facts and that its assertion to the effect that heredity does not depend on environmental conditions, and characteristics acquired in the course of life are not transmitted hereditarily has been left unproved. A tendency to revise a series of principles of contemporary genetics in the light of Michurin's teaching has been observed in foreign science. The teaching on the independence of heredity from external conditions and the problem of hereditary transmission of acquired characteristics are becoming increasingly subjects of doubt. Thus, the basic principles of Michurin's genetics increasingly attract the attention of and exert their influence upon West-European science.

It must be noted that the editorial board of the "Botanical Journal" [Botanicheskii Zhurnal] had taken a much more irreconcilable position with regard to Michurin's direction, than have many scientists in the West.

The new staff of the editorial offices of the "Botanical Journal" [Botanicheskii Zhurnal] deems it necessary to declare that all of its work will be built on the basis of the original

course charted by the brilliant Russian scientist, I.V. Michurin. "Michurin's direction in biology is based on the firm foundation of dialectic materialism, it continues and develops the great Darwin teaching. Therin lies its perceptive strength and practical efficacy. Proceeding from the recognition of the unity between an organic form and its habitat, Michurin's biology develops as a science that deals with the direction of heredity and its variation, as a science that deals with the direction of the processes of evolution in the interest of society". ("Pravda", no. 349 of December 14, 1956).

The new staff of the editorial offices considers that precisely Michurin's direction in biology is methodologically correct and, therefore, very fruitful for the development of theory and practice. In a leading article of "Pravda", numerous ^{are given} examples of the importance of the achievements of Michurin's science in the practice of national economy in our country: "During the years of Soviet authority, and especially in recent times, our breeders have created remarkable varieties, such as, for example, the winter wheats: "Novoukrainka", "Belotserkovskaia-198", the selected varieties of the All-Union Genetics-Selection Institute - "Odesskaia-3", "Odesskaia-12", "Odesskaia-13 and others that occupy in our country many millions of hectares of winter crops. The same applies to spring

wheats and other crops.

"In the last [few] decades, Soviet breeders and cotton growers have made tremendous strides in raising the productivity of cotton plants. In cotton yields, our country holds first place in the world".

The editors of the "Botanical Journal" [Botanicheski Zhurnal] did not write on the pages of the Journal about these and other achievements of Soviet biological science, but, at the same time, persistently advertized works on polyploidy and roentgen-mutations. The point is not in the negation of the importance of other numerous methods used in exerting action of various physical and chemical agents (ionizing radiation, colchicine and others) that lead, in particular, to changes of such cell organoids as chromosomes, [Begin p. V] but in the necessity of using as a basis the following opinion of I.V. Michurin: "In raising seedlings and growing from them productive plants, it is essential to use means that depend on man for the purpose of deviating the structure of the young plant organismⁱⁿ the cultural direction that we need. In the selection of methods to this end, preference must be given only to those [means] that in achieving the required results disturb less than others the vital processes in plants".¹

¹ I.V. Michurin. Works, v.1. Ogiz [State United Publishing Houses] - Sel'khozgiz. 1939, p. 178.

It is not surprising that selection practiced for the creation of new varieties proceeds exactly over Michurin's course, utilizing widely also the method of rearing, the importance of which I.V. Michurin emphasized in the following words: "Here, it must be said that in the matter of improving plant varieties, not only selection alone, that is used so widely by our experimental selection stations, is incapable of producing new varieties with adequate resistance to degeneration, but even all types of hybridization with the very strictest selection cannot produce completely satisfactory results without a special regime for the rearing of seedlings up to their maturity".²

A thorough study of a series of biological problems with the aid of the latest investigative methods (isotopes, electron, ultra-violet and fluorescent microscopes, etc,) can give and does give a great deal of knowledge about the regularities of the vital processes, but this type of work must be conducted from the standpoint of genuine materialistic biology, and not from the position of ideas based on principles of corpuscular genetics. Michurin's direction in biology does not deny facts that have obtained and are being obtained also by the representatives of corpuscular genetics, but it discards the erroneous interpretations

² I.V. Michurin. Works, v.1. Ogiz - Sel'khozgiz. 1939, p. 595.

that have been attached to them.

As a sample of entirely unacceptable forms of discussion carried on by the "Botanical Journal" [Botanicheskii Zhurnal] we shall cite the following example. In an article by P. A. Baranov and collaborators³ it says as follows: "Regardless of the complete simplicity of the problem concerning the production importance of double interlinear hybrids, T.D. Lysenko and others continue to speak against the leading scientific methods and against the adaptation of double interlinear hybrids". Let us see how T.D. Lysenko's statements really look; he published them back in 1947, long before the article by P.A. Baranov and collaborators appeared in print: "The hybrid seeds of maize that produce a good increase in productivity may be [the resultant] of crossing two local (planted in the district) easily separable varieties, or of crossing one local variety (maternal form) with a specially selected inbred line.

"Selection stations must expand the work of creating and selecting original maize material for the production of hybrid seeds".⁴ [Begin p. VI].

The above quotation shows how tendentiously the material cited on the pages of the "Botanical Journal" [Botanicheskii Zhurnal]

³ P. A. Baranov, N.P. Dubinin, M.N. Khadzhinov. Problems of hybrid maize. (Fundamental tasks and methods for their solution). "Botanicheskii Zhurnal", no. 4, 1955.

⁴ Zhurn. "Agrobiologiya", no. 2, 1947.

had been selected and elucidated.

The new editorial board decidedly condemns similar methods of distortion of the concepts and viewpoints of authors and will not tolerate them on the pages of the "Botanical Journal" [Botanicheski Zhurnal]. The new staff of the editorial offices deems it very important that a discussion be conducted not only by means of verbal argumentation, but also by means of new factual material figuring in it, for without it a discussion of any branch of science is inconclusive. This, for example, applies to the discussion of species and species formation conducted by the "Botanical Journal" [Botanicheski Zhurnal] that was of a very one-sided character. The new editorial board will pay principal attention to the publishing of original articles devoted to the development of actual problems of the taxonomy and morphology of plants, especially of the lower type, to anatomy, geobotany and other sections of botany that are not elucidated in other journals. The editorial board considers as especially important ^{the} original publication of works that deal directly with practical problems, i.e. with the development of our agriculture, industry and medicine.

The historical seven-year plan for the development of the national economy of the USSR (1959-1965), adopted by the 21st Congress of the Communist Party, Soviet Union, confronts Soviet botanical science with vast and responsible tasks. Botany must

provide the scientific basis for the mobilization of all the natural riches of the plant world of our country (especially of its eastern regions) for the needs of our State.

The realization of this important task will, in turn, require the participation of the "Botanical Journal" [Botanicheskii Zhurnal] in matters dealing with the development of theoretical problems of the botanical science based on the philosophy of dialectic materialism.

The editorial board of the Journal calls on the entire body of botanists of the Soviet Union, of different specializations, to enlist creatively in the development and solution of the great problems that were put before the botanical science by the age which our country entered after the historical 21st Congress of the Communist Party, Soviet Union, - the age of building a Communist society.

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Medved', L. I.

Gigiena truda pri primenenii insektofungitsidov
v sel'skom khoziaistve.

[Hygiene of work in the use of insectofungicides in
agriculture].

Moskva, Gosudarstvennoe izdatel'stvo
Meditsinskoi Literatury, 1958. 190p.
(Not in DA Lib.)

(In Russian)

Partial, i.e. p.3-8. 175-184, and Table of Contents.

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Foreword, p.3-4

Prophylaxis of insectofungicide poisoning that constitutes a very important problem for rural medico-prophylactic establishments can be successful only in case it is practiced on the basis of knowledge of the toxic properties in the preparations used and of hygiene practiced during their application. Meanwhile,

information concerning the results of a toxicologic, hygienic and clinical study made of individual preparations is published in different journals, collections of scientific works, theses of scientific proceedings of conventions and conferences that are published largely in small editions and, hence, are unavailable to physicians of rural medico-prophylactic establishments.

The need for publishing a manual on hygiene in the use of insectofungicides is long overdue. Requests for the publication of such a manual have been voiced persistently at meetings of provincial [vyezdnykh] sessions of the Academy of Medical Sciences USSR, devoted to problems of the medico-sanitary service for the rural population, held in Krasnodar (1954) and Novosibirsk (1955), of the 13th All-Union Convention of Hygienists (Leningrad, 1956), of the 1st All-Union Conference on the Hygiene and Toxicology of Insectofungicides (Kiev, 1957) and at other conferences and meetings of doctors, as well as in printed material.

The present manual has been prepared for the purpose of rendering aid to doctors of rural medico-prophylactic establishments in their noble endeavor to safeguard the health of the workers of socialist agriculture. In determining the format of the book and stating individual problems, we took into consideration the wishes of practicing doctors which they have expressed regarding lectures read by us at inter-oblast' seminars for physicians

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of the Ukrainian SSR devoted to hygiene in agricultural work [Begin p.4], including hygiene in the use of insectofungicides (1956). Information on the designation of the individual preparations, processes and methods for their use, on machines and apparatuses utilized in the application of insectofungicides is stated briefly, to the extent necessary to substantiate recommended sanitary-hygienic salutary measures.

Due to the fact that manuals on general toxicology have not been published for a long time, and the books that were published have become bibliographic rarities, the information furnished on the toxic properties of individual preparations is preceded by brief data on general toxicology of insectofungicides. Knowledge of the general regularities of the reciprocal action occurring between poisons and the organism is extremely necessary in being able to understand concrete data on the toxic properties of the individual preparations. In explaining symptomatology of intoxication by the individual preparations, the results of clinical observations of people described in Soviet or foreign literature have been cited to the extent possible. Fundamental recommendations for first aid measures and prophylaxis to be used in cases of poisoning have also been cited. Some of the information on the toxicology of insectofungicides and on hygiene in their application is published for the first time.

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The present book is the first attempt [to present] a generalized version of the problems of hygiene in the use of insectofungicides, hence it must be expected that it has a number of gaps and is not devoid of shortcomings. The author will be grateful to receive suggestions and critical comments and will take them into consideration in the next work of hygienic research on insectofungicides.

Introduction, p.5-8

In the majestic program developed by the Communist Party and Soviet Government for a steep rise in agriculture, a significant place is assigned to a further increase in the production of chemical means for the control of pests and diseases of agricultural plants; the use of such means is the most important condition for increased productivity. The high level of development of theoretical chemistry in our country, especially of organic synthesis, and of the chemical industry provides for a steady increase in the use of chemical preparations in agriculture and in the adaptation of new, more effective insectofungicides. In this respect, the following data concerning an increase in the use of poisonous chemicals in agriculture in the USSR¹ are very indica-

¹ Information for the years 1924, 1927 and 1933 has been borrowed from the book "Insecticides and fungicides", by A. L. Efimov and I. A. Kazas (Sel'khozgiz, 1940). Information for 1940 and 1956 - from the book "Theses of the 1st All-Union Conference on Hygiene and Toxicology of Insectofungicides," by D. M. Paikin and P. I. Galakhov.

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tive: in 1924 - 1,200, [000?] tons, in 1927 - 7,000 tons, in 1933 - 30,000 tons, in 1940 - 50,000 tons, in 1956 - over 300,000 tons.

In accordance with the historical decisions of the 20th Congress of the Communist Party, Soviet Union, production of effective poisonous chemicals serving the needs of agriculture will be considerably increased by the end of the sixth five-year plan. The use of chemicals in agriculture that plays an important role in providing high yields is accompanied in our country by the introduction of sanitary-hygienic, salutary measures that provide safety in working with poisonous chemicals. In this connection, it must be borne in mind that from the point of view of State and public interests a distinction is made between two aspects involved in the widespread use [Begin p.6] of chemistry in agriculture - the positive and negative.

The positive aspect is based on the fact that the use of the chemical method in the protection of plants from pests and diseases, as the more effective one fitting into the general plan of measures employed to provide high yields of agricultural crops, contributes toward the creation of an abundance of foodstuffs for the population and raw material for industry. In reports read at the 1st All-Union Conference on Hygiene and Toxicology of Insecto-fungicides, P. V. Sazonov, D. M. Paikin and P. I. Galakhov pointed out that measures conducted for the protection of agricultural

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crops from injurious insects can already now provide additional agricultural production in our country amounting to the sum of 45 billion rubles. Destruction of weeds by chemical means decreases the consumption of manpower for the weeding of plants.

The negative aspect of the indicated method is based on the fact that in the application of insectofungicides there occur industrial injuries that, under certain conditions, could have an unfavorable effect upon the organism of the people who perform the work. The food products obtained from plants treated with poisonous chemicals may contain residual quantities of toxic chemical substances in amounts dangerous for the health of the population that consumes the indicated products. Contamination of the water and the air in populated areas by individual poisonous chemicals and their accumulation in the soil are also possible.

Not only the danger of acute or chronic poisonings must be taken into consideration, but also the possibility of a non-specific action of insectofungicides upon the organism of people that can manifest itself by decreased reactivity of the organism. A series of investigations has demonstrated that continued action upon the human organism exerted by individual chemical irritants of low intensity is likely to lead to a decreased reactivity of the organism, thus, contributing toward a higher incidence of disease in general. Constant attention must be paid to the problem of carcinogenicity of individual substances. There are indications

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that Carbolineum and its preparations contain admixtures of carcinogenic substances. [Begin p.7].

In our country annually, from early spring until late fall, millions of kolkhozniks and workers of RTS [Tractor Repair Stations], MTS and sovkhoses come in contact with poisonous chemicals. Such contact occurs during transportation, storage and release of preparations, during the chemical treatment of seeds and when they are planted, during dusting and spraying of plants, fumigation of soil, preharvest defoliation of cotton, scattering of poisonous bait for the destruction of mouse-like rodents and in the performance of other work for the protection of plants from pests and diseases. Such contact takes place also during the production of poisonous chemicals. In carrying out the work indicated, there may arise conditions under which toxic substances may enter the organism of the people at work in amounts capable of causing intoxication. The main task is the prevention of such a possibility.

In using insectofungicides, as well as in the performance of other agricultural work, sanitary working conditions depend on the quality and intensity, within the limits possible, of the action exerted by various factors of the external production environment upon the organism of the people at work, and also on the character of the production operations being conducted. Dust-

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like insectofungicides are likely to produce considerable dust in the air of the working zone, and in spraying plants and fumigating the soil it is possible that fumes and gases may enter the air. In the early spring work (chemical treatment of seeds) is conducted at comparatively low air temperatures (2-5°) and a high relative humidity, but in the summer (dusting and spraying of plants) at a high air temperature (25-32°)[C]) and a considerable insolation. When machines and apparatuses are used, there frequently are noises and vibrations that exceed in intensity permissible sanitary standards. In the chemical treatment of seeds, the workers lift and carry heavy loads (grain in bags, buckets etc.), rotate the drum of the treating apparatus and perform other operations that are connected with certain physical exertions and an inconvenient working position. The same takes place in manual dusting and spraying of plants with the aid of knapsack equipment. Under certain conditions, the factors listed above can exert unfavorable action upon the organism of those who do the work, [Begin p.8] but it is usually of a temporary character, which is determined by the seasonal nature and short duration of the work. For example, dusting and spraying of plants is carried out within a few days and is repeated several times during the season. Seeds are treated on the eve of sowing.

Sanitation measures must be designed for the prevention or mitigation of the unfavorable effect of all factors of the ex-

ternal production environment upon the organism of the workers, but special attention must be paid to the prophylaxis of poisoning caused by insectofungicides. The distinguishing characteristic of sanitary working conditions in the use of insectofungicides, as compared with other agricultural work, is the contact of the workers with toxic substances. The danger of poisoning by insectofungicides depends not only on the toxic properties of the individual preparations, but also on the conditions of their application. Our research has established that the diffusion of the preparation in the air of the working zone and their concentration in it depend on the processes and methods of their application, and also on the constructional characteristics and working order of the machines used.

Efficient sanitary measures to be used in the prophylaxis of poisoning caused by insectofungicides can be developed only on the basis of data concerning the toxic properties of a preparation, the methods and processes of its application, the characteristics of the machines and apparatuses used, and on other data characterizing sanitary working conditions. All of these problems are elucidated in the following chapters of the book.

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Appendix (p:175-184)

APPROVED

Chief State Sanitary
Inspector USSR

V. Zhdanov

August 18, 1955

Sanitary Rules for Storage, Transportation and
the Use of Poisonous Chemicals in
Agriculture¹

1. General Principles

1. The present rules are applicable to all types of work with poisonous chemicals used in Agriculture and are mandatory for all raions and oblasts of the Soviet Union.

2. At present, in the control of pests and diseases of agricultural plants there are used mercuric preparations (NIUIF-2 [Scientific Research Institute of Fertilizers and Insectofungicides] - granosan containing ethylmercuric chloride, NIUIF-1, preparations of arsenic, sodium arsenite, calcium arsenite, calcium arsenate, and Paris green), copper preparations (AB, trichloro-phenolate of copper and Bordeaux mixture), fluorine preparations (sodium fluoride and fluosilicate); alkaloids (nicotine-sulfate, anabasin-sulfate; chloro-organic compounds (DDT, benzene hexachloride, chlor-ten and others); organic phosphorus compounds (NIUIF-100 - thiophos, metaphos, carbophos, octamethyl, mercaptophos and others), formalin, barium chloride, chloropicrin, dichloroethane, salts of hydrocyanic acid and others. All of these are poisons for warm-blooded animals and people and may upset the state of their health when diffused in the organism. Hence, it is essential for persons who work with the preparations listed above strictly to observe the present sanitary rules.

¹ Developed with the assistance of the Kiev Institute of Hygiene of Work and Industrial Diseases.

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3. Those who work with poisonous chemicals must be instructed about their poisonous properties and about safety methods to be used in working with such chemicals.

4. Persons assigned to work with poisonous chemicals must pass a preliminary medical examination.

5. Indications disqualifying from work with any poisonous chemicals include:

- a) organic diseases of the central nervous system;
- b) psychic diseases (including stages of remission);
- c) epilepsy;
- d) endocrine vegetative diseases; [Begin p.176].
- e) active form of tuberculosis of the lungs;
- f) bronchial asthma;
- g) inflammatory diseases of respiratory organs (bronchitis, laryngitis);
- h) diseases of the gastric tract (ulcers of the stomach, chronic gastritis; chronic colitis);
- i) pronounced forms of diseases of the liver;
- k) diseases of the kidneys (nephritis, nephrosis, nephrosclerosis;
- l) diseases of the eyes (chronic conjunctivitis, keratitis, diseases of the tear ducts [sleznye puti] and the eyelids).

6. Additional indicators disqualifying from work are:

- a) with organic mercury compounds - chronic or frequent recidivation of stomatitis, gingivitis, alveolar tyorrhea;
- b) with arsenic preparations - diseases of the nose (atrophic rhinitis, ozena, sycosis of the nose, diseases of nasal accessory sinus, deviation of

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the nasal septum, swelling of the upper respiratory organs, eczema on the face and hands);

c) with nicotine and anabasine - diseases of the cardiovascular system, transitional amaurosis with a limited visual field;

d) with organic phosphorus preparations - distonia of the vegetative nervous system, spastic colitis, diseases of the stomach with upset secretion, diseases of the cardiovascular system.

7. Persons who work systematically with poisonous chemicals must undergo periodically medical examinations, not less than once every six months.

8. 18-year old juveniles are not permitted to work with poisonous chemicals, nor are pregnant or nursing women.

9. The use of alcoholic drinks during the period of work with poisonous chemicals is categorically prohibited.

10. Work that involves contact with poisons includes;

a) transportation of poisonous chemicals from the manufacturing plants to the Republic, oblast', inter-district and district agricultural supply bases and from the bases indicated to kolkhoses and sovkholes;

b) storing at agricultural supply bases;

c) chemical treatment of seeds of agricultural crops, their transporting, storing and seeding;

d) dusting and spraying of plants, introduction of insectofungicides into the soil, preparation of bait, treatment of animals with insecticides and other instances of the use of poisonous chemicals in production.

11. If precautionary measures are not observed, the poisonous chemicals may enter the organism of workers and of other people who come in contact with them through the upper respiratory tract in the form of dust, vapors and gases, through the mouth when dust is swallowed, when people are smoking or handling the food they eat with dirty hands. Some poisons, for instance, such as organic mer-

cury phosphorus preparations, organic chlorine preparations, nicotine, anabasine, hydrocyanic acid and others can enter through the uninjured skin.

12. Work with insectofungicides must be conducted under the supervision of specialists in the protection of plants from pests and diseases, and also under the supervision of agronomists, zootechnicians, veterinary physicians of kolkhozes, sovkhozes and other farms who have had training in the use of precautionary measures when working with poisonous chemicals.

13. Poisonous chemicals must be stored, transported and released only in a special, stable, well covered container, in accordance [Begin p.177] with TU [technical specifications] for their preparation with the inscription "Poison" and indicating the name and quantity of the preparation.

14. Those who work with poisonous chemicals must be provided with special wearing apparel made from a compact dust-proof fabric of the moleskin type (overalls or robes), special footwear (rubber boots, shoes, overshoes), respirators, gas masks, goggles and gloves.

The special wearing apparel must not have pockets and must be buttoned and tied in the back. Respirators and goggles must be of corresponding sizes and must be selected for each worker individually. The special wearing apparel must be selected in accordance with the size of the workers.

15. Giving permission to work with poisonous chemicals to persons not provided with special wearing apparel, special footwear and protective devices is categorically prohibited.

16. When the work with poisonous chemicals is finished, the worker must take off his special wearing apparel, clean it carefully of dust and leave it in a locker in a separate room isolated from the place where poisonous chemicals are stored. Storing special wearing apparel in a house or in rooms not designated for this purpose is categorically prohibited.

17. Water, a wash-basin, soap and a towel must positively be kept near the places where work is being done with poisonous chemical, but beyond the zone of contamination.

18. Those working with poisonous chemicals must strictly observe the rules of personal hygiene: not to eat any food, not to drink and not to smoke on places of work. Food can be eaten

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in a specially assigned place, not less than 100 meters removed from the place of work. The special apparel must be taken off, hands and face must be washed and one's mouth must be rinsed before eating. When the work is done, the whole body must be washed carefully with water (under a shower or in a natural reservoir).

19. Storing of groceries, water, forage and household articles in places where work is carried out with poisonous chemicals is prohibited.

20. Outsiders and especially children are not permitted in an area where work is carried out with poisonous chemicals.

21. Leaving poisonous chemicals in a field or any other place without a guard is prohibited.

22. When the work with poisonous chemicals is finished, the remainder that is unfit for further use must be rendered harmless and dug into a specially made pit at a depth of one meter, situated far from dwelling houses, cattle yards etc.

The destruction of poisonous substances must be carried out in accordance with an instruction confirmed by the Ministry of Public Health USSR and the Ministry of State Public Safety USSR.

23. The length of time spent working with poisonous chemical must not exceed 6 hours, and in the application of strong insectofungicides (preparations of mercury, arsenic, nicotine, anabasine and organic phosphorus compounds) - 4 hours.

In the treatment of seeds the work must not be continued for more than 4 hours, regardless of the type of poisonous chemical. The rest of the working day will be used up doing work that is not connected with poisons.

24. When symptoms of poisoning appear in workers, the victim must be given first aid and immediately after taken to the nearest medical center. The workers must be familiarized with the rules of first aid administered in cases of poisoning. [Begin p.178].

25. In the event a worker is poisoned, one must strictly observe the regulations for notification and registration of industrial poisonings and industrial diseases confirmed by the People's Commissariat of Public Health USSR, February 16, 1939.

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26. Every year, before work with poisonous chemicals is begun in agriculture, medical workers (a fel'dsher, a rural district doctor under the jurisdiction of the Raion Sanitary-Epidemiological Station) must on the spot instruct the workers about the properties of the poisons used, the rules for working with them, precautionary measures and first aid. Special instruction must be carried out when new poisonous chemicals are introduced in agriculture.

27. Instruction, posters and memoranda about precautionary measures to be used when working with poisonous chemicals and rules for the administration of first aid in cases of poisoning, issued by the Ministry of Public Health USSR and the Ministry of Agriculture USSR, must be available at MTS [Machine Tractor Stations], on kolkhozes and sovkhozes and on other farms.

II. Precautionary Measures to be Used in Storing Poisonous Chemicals.

1. Poisonous chemicals must be stored only in warehouses specially designated for this purpose: Republic, inter-district and district bases, agricultural supply warehouses, as well as in the warehouses of kolkhozes and sovkhozes and other farms.

2. Kolkhov and sovkhov warehouses for poisonous chemicals must be situated in a dry place, preferably on the outskirts of a town or village, at a distance of not less than 200 meters from dwelling houses, food and agricultural objects (dining rooms, dairy farms etc.).

3. The premises of the warehouse must be dry, spacious and light. The walls must be solid and without cracks. The roof must be in good condition, the floor smooth, asphalted or cemented. Wooden floors are not permitted.

4. Lighting must satisfy the standards of hygiene and must be adequate for the conduct of the operations of weighing and measuring of poisonous chemicals (N101-54).

5. Warehouses on kolkhozes and sovkhozes must be provided with natural ventilation (draft airing by means of opening windows or casements), and at the agricultural supply warehouse, an artificial exhaust fan in addition, (supplement no. 3).

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6. The premises of a kolkhoz warehouse must consist of not less than two sections: a) the section for storing and releasing poisonous chemicals, b) the section in which special wearing apparel, water, soap, and medicine chest for the administration of first aid in cases of poisoning must be kept.

7. A specially trained person - the manager of the warehouse of poisonous chemicals - is responsible for the storing and release of the poisonous chemicals.

8. Outsiders are prohibited from entering the warehouse premises. Warehouses of strong poisonous chemicals must have a special guard.

9. The presence of the warehouse man at the warehouse of poisonous chemicals is permitted only at the time chemicals are released or received.

10. The warehouse must have scales, small weights and scoops that are to be used only for weighing and measuring poisonous chemicals. [Begin p.179].

11. Safety measures precluding the possibility of chemicals getting into the zone of respiration or on the skin of workers must be observed when a container is opened.

12. Paper and wood containers emptied of poisonous chemicals must be burned in specially designated places, must at once be rendered harmless and turned over to the central warehouses. The use of containers emptied of poisons for storing or for the preparation of food stuffs, feed, water and other articles is categorically prohibited.

13. A record of storing and the release of poisonous chemicals is kept in a special ledger according to the sample established by the Ministry of Agriculture USSR.

14. Poisonous chemicals can be released from the warehouse only upon the presentation of a written order from the chairman of a kolkhoz, a director of a sovkhos or from their deputies, and only to the person who is responsible for the conduct of the work with poisonous chemicals.

15. At the end of the working day, poisonous chemicals that are left over must be surrendered to the warehouse where they must be kept in a tightly covered container. Under field conditions, the poisonous chemicals not used up during the day must be turned over to the responsible person for safekeeping.

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16. Release of poisonous chemicals must be conducted so as to preclude their getting into the zone of breathing or on the skin of workers. If poisonous chemicals drop on the floor or on other surfaces, they must immediately be rendered harmless in compliance with the corresponding safety measures (supplement no. 5).

17. Poisonous chemicals must be released from a warehouse in a closed container, indicating the name of the chemical and with the inscription "Poison".

18. Poisonous substances that have become unfit for use due to long or incorrect storage in warehouses must be destroyed in accordance with the instruction on the order in which strong, poisonous substances must be destroyed.

19. The allocation, construction and content of base and dispensing warehouses must be accomplished in accordance with the sanitary rules confirmed by the Head State Sanitary Inspector of the USSR, on April 16, 1956, under no. 210-56.

III. Safety Measures to be Used in Transporting Poisonous Chemicals

1. Transportation of poisonous chemicals must be carried out with the observance of all precautionary measures. Persons accompanying the transport must wear special apparel and must strictly observe the rules for handling poisonous chemicals.

2. Hauling of poisonous chemicals can be carried out only on a transport that is easy to clean and render harmless (carts made of boards in good working order, trucks etc.).

3. Hauling of food stuffs and other merchandise and articles together with poisonous chemicals is categorically prohibited. A transport designated for hauling food stuffs and passengers cannot be used for transportation of poisonous chemicals.

4. Damaging the container, knocking against, throwing, spilling and strewing of poisons etc. must be avoided during loading and unloading. [Begin p.180].

5. Persons who accompany a transport with poisonous chemicals are obligated at all times to watch the condition of the container. In case the container is damaged, the motorized vehicle or the cart must be stopped immediately and the container must be repaired with the means available.

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6. When the hauling of poisonous chemicals is finished, the motorized vehicle and the cart must be carefully cleaned, washed and rendered harmless, and only after this they can be put to further use. Cleaning of the transport must be carried out on a specially assigned place that is safe for people in the vicinity, in accordance with instructions of local sanitary inspection agencies.

7. Those hauling poisonous substances should be guided by the instruction "Provisions of hauling strong, poisonous substances in a wagon or in a motorized transport", issued by NKVD [People's Commissariat of Internal Affairs] USSR in 1939.

IV. Safety Measures to be Used in the Chemical Treatment, Transportation and Sowing of Seeds

1. Chemical treatment of seeds must, as a rule, be carried out in the open air, far from dwelling houses (not nearer than 200 meters). In rainy weather treatment can be conducted under a hangar. The direction of the wind must be taken into consideration and workers must be stationed so as not to have them in the zone where the poisonous chemicals are dispersed. It is also necessary to watch that the wind should not carry the poisonous dust onto dwelling houses, cattle yards and pastures.

Note. Treatment of seeds is permitted to be carried out indoors only if there is a possibility of arranging effective airing.

2. Chemical treatment of seeds must be carried out with the aid of special apparatuses or machines (PU-1, PSP-0.5) that are in good working condition.

3. Seed treated with apparatuses must be delivered in sacks made of a compact fabric. The brim of the sack must be fitted closely into the unloading opening. Pouring of treated seeds from an unloading opening onto the floor or into a bucket is prohibited.

4. Only the amount of grain required for seeding is to be treated. The use of treated grain for nutritive purposes, and also for feed of cattle and fowls is categorically prohibited. The use of treated grain for nutritive purposes after it has been washed, aired and cleaned of poisonous chemicals also by other methods, is also prohibited. It is recommended that the remainder of treated

grain be turned over to another kolkhoz or sovkhos for seeding purposes.

5. Mixing of treated grain with non-treated and surrendering it to grain procurement centers is categorically prohibited. Bags containing treated grain must be marked: "CHEMICALLY TREATED", "POISON". Treated grain must be stored separately from foodstuffs and feeds.

6. After the issuance of treated seeds for sowing, the released room must be thoroughly cleaned and waste must be removed with a damp broom [vlazhnaia uborka].

Treated grain spilled in the room and mixed with rubbish must be swept up carefully and burned. [Begin p.1819].

7. Only seeders in good working condition should be used in sowing treated seeds. The lid of the seed box must be covered tightly during the sowing. It is not permitted to work with an open or broken lid.

Smoothing out the surface of treated seeds in a seeder with one's hands is prohibited.

8. Planters must be warned about the poisonous properties of treated seeds. Sowing of treated seeds by hand is not permitted.

9. Treated seeds must be transported in bags made of a compact fabric that are well sown together or tied and are in good working condition. Treated seeds must not be transported without a container.

10. The driver and other persons are not permitted to sit on bags with treated seeds. A special seat must be adjusted for a person who hauls treated seeds in a wagon.

V. Safety Measures to be Used in Dusting and Spraying of Plants and with other Methods of Application of Poisonous Chemicals

1. Only special equipment of diverse power (airplane-carried, tractor-drawn, horse-drawn and hand operated sprayers and dusters) are permitted to be used in dusting and spraying of plants with insectofungicides. Dusting by hand and also with the aid of woven bags [kul'ki] is prohibited.

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2. Signs of warning must be provided on places of work and on roads for the benefit of those who pass through fields, orchards and other places that have been treated with poisonous chemicals.

3. Grazing of cattle is not permitted near places that are being treated with poisonous chemicals. Grazing of cattle on areas that have been treated is permitted only 25 days after the last treatment, and in cases of specially toxic and persistent poisons after periods indicated in special instructions.

4. Dusting and spraying in a strong wind is prohibited.

5. Workers who carry out dusting and spraying must be stationed so as to prevent dust and fumes of poisonous chemicals from getting into the zone of breathing.

6. Spraying of plants must be conducted mostly in the morning and evening hours. Plants must not be sprayed when there is a heavy dew. It is recommended to dust plants in the morning and evening after the dew has evaporated.

7. The last treatment of the young crop or plantings must be finished not less than 20-25 days before the yield is harvested.

8. In aero-chemical treatments of plants it is necessary:

- a) to provide all persons likely to be exposed to the action of poisonous chemicals with special apparel and individual protective devices ([such persons include] pilots, aviation technicians, signalers, workmen who take part in the preparation of the solutions of poisonous chemicals and in filling the airplane tank with the solutions);
- b) to mechanize the preparation of solutions of poisonous chemicals on a field aerodrome and the filling of an airplane tank; [Begin p.182]
- c) to station signalers with due consideration of the direction of the wind, so that they would be outside the wave of the poisonous chemical. As the airplane approaches within 50-100 meters, the signalers must step aside.

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9. Persons working on areas that had been treated with poisonous chemicals earlier must strictly observe the necessary precautionary measures (protection of the respiratory tract, special apparel and special footwear, a shorter work day, elimination of any possibility of a contact of the skin and mucosa [slizistye] with treated objects etc).

10. The direction of the stream of a poisonous chemical used in dusting and spraying must preclude any possibility of its falling inside the zone of respiration, on the skin and the clothes of the workers.

11. Poisoned bait used against rodents must be prepared in a room that can be properly aired or outdoors. Places where solutions and poisoned bait are prepared must be rendered harmless or dug up after the work is finished.

12. Fumigation of warehouses can be conducted only in cases in which the warehouses are situated at least 50 meters from dwelling houses and from livestock farms. All cracks and openings must be carefully sealed before the premises are fumigated.

13. During the fumigation period the warehouses must be under constant guard.

14. After the fumigation is finished, the windows and doors must be opened one after the other so as not to allow a large quantity of gas to flow out simultaneously. Work can be begun in the warehouse only after a complete airing (absence of an odor of poison).

15. Fumigation of rooms and grain can be carried out only by brigades that are specially trained for the control of pests and diseases of agricultural plants.

16. All production rooms situated within a 50 meter radius from the fumigation object must be closed for the duration of the fumigation.

17. Barrels with poisonous chemicals to be used for fumigation must be opened with the aid of special keys. Heating of the plugs in barrels or taking them out is prohibited.

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VI. About Inspection of the Observance of Current Rules

1. Inspection of the implementation of current rules is entrusted to the agencies of the State Sanitary Inspection [Service] and of the Technical Inspection [Service] of the TsK Profsoiuza [Central Committee of the Trade-Union].

2. Upon instruction of sanitary inspection agencies, inspection of the observance of sanitary rules is conducted also by the medical division and the fel'dsher-obstetrical centers located in villages.

3. The current rules are mandatory for all Ministries and departments using poisonous chemicals in agriculture.

4. Persons guilty of a violation of the rules will be held criminally liable according to the existing articles of the Criminal Code of the Union Republics, or to the responsible administrative agencies of sanitary or technical inspection. [Begin p.183].

Methods of Detoxication of Containers, Premises, Transportation Facilities and Special Apparel from [the Effects of] Certain Poisonous Substances

1. In working with highly toxic poisonous chemicals (organic arsenic, mercury, and phosphorus compounds, cyanide, chloropicrin, mercuric chloride, nicotine, anabasine and others), it is necessary to detoxicate protective apparel, premises, containers and transportation facilities contaminated by poisonous chemicals.

2. Detoxication of strong substances must be carried out under the supervision of persons who know the physico-chemical and toxic properties of defumigation substances.

3. Personnel taking part in the work of detoxication must be supplied with appropriate protective apparel. When the work is finished, it is necessary to wash the whole body with water, or to take a shower.

4. To render harmless containers, premises and transportation facilities contaminated by organic mercury preparations (granosan, NIUIF-1), it is recommended to treat the contaminated surface with a solution of a calcium hypochlorite mixture (at a ratio of 1 kg of calcium hypochlorite to 4 liters of water) and to let it alone for 4 hours. Then treat it with a 3%-10% solu-

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tion of sodium chromosulfite [khromsernistyi natrii], or with a 10% solution of potassium permanganate. After 24-hours, the treated surface should be washed with warm soap-water.

As a detoxication means for bags, it is recommended to soak [the bags] in a 1% solution of potassium permanganate acidified with hydrochloric acid (5 ml HCl per liter of solution), after which [the bags] must be washed in hot soap-water and rinsed repeatedly.

5. Defumigation of containers (iron drums, glass dishes) contaminated by organic phosphorus insecticides (thiophos, mercaptophos, metaphos, octamethyl, carbophos and others) can be carried out with a 5% solution of sodium hydroxide. Then the container must be washed thoroughly with water. In the event the preparations are dropped on the floor then these areas must be treated immediately with the mush of calcium hydroxide and 20-30 minutes later washed with water.

When the floor is being washed and the premises are being cleaned, it is recommended that sodium carbonate in a ratio of 20 gm per liter of water be added to the water.

After hauling, the transport (carts, wagons and trucks) must be defumigated with a 5% solution of sodium hydroxide which later is washed away with water.

Special apparel and bags are soaked in ^{an} aqueous solution of sodium hydroxide (20 gm of soda pre liter of water) for 1-2 hours and later are wrung out and washed by the usual method.

Rubber boots, gloves, and aprons are defumigated by means of rubbing with the mush of calcium hydroxide and then washing profusely with water.

6. To detoxicate containers (iron drums and glass dishes) contaminated by organic chlorine preparations (chlorten, chlorindan and others) they must be treated with a solution of sodium hydroxide, or with a 3% solution of calcined soda, then washed in pure water and dried.

7. Apparel and bags contaminated by insecticides containing arsenic must be soaked in a hot 1% solution of copper sulfate, [Begin p.184] then taken out and put in a 2% sodium carbonate solution and a 2% ammonium sulfate solution. (The work must be conducted in a draft [pod tiagol] or in the open air). The apparel must be turned from time to time. After 30-60 minutes it

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is taken out and rinsed thoroughly until the apparel submerged in water stops giving off a blue coloring. The same method is used to defumigate iron drums contaminated by insecticides containing arsenic.

8. Glass and metal containers emptied of carbon disulfide are rendered harmless by washing profusely with a 3%-5% alkaline solution, or by means of boiling, and also by leaving them in an upside-down position with the opening downward at a certain distance from the ground (5-10 cm).

9. Containers emptied of cyanide and smelted cyanide [tsianplav] (besides insoluble ones - silver cyanide, copper cyanide and lead cyanide) are detoxicated with a mixture of a 10% solution of ferrous sulfate [zheleznyi kuporos] and calcium hydroxide (2 : 1). The containers are immersed into this freshly prepared solution for 3-4 hours, afterward they are rinsed with water.

10. Glass and metal containers emptied of DDT and benzene hexachloride preparations are rendered harmless with a 3%-5% sodium hydroxide solution. Bags must be shaken out carefully and then washed in hot water with lye.

11. The water used in treating containers, premises, apparel etc. that contains a residue of poisonous chemicals is poured into a specially fenced-in pit and treated with mush of calcium hydroxide, after which the pit is dug in.

12. Detoxication work is conducted in the open air or in a specially outfitted room.

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(in part)
vg/A

Rudenko, A. I.

Vliianie zasukhi na urozhai kartofella.

[Influence of drought upon the potato yield].

In Zasukhi v SSSR, ikh proiskhozhdenie, povtoriaemost' i vliianie na urozhai*, p.71-93. Leningrad, Gidrometeorologicheskoe izdatel'stvo, 1958, 345 213

(In Russian)

Excerpt only, i.e. p.89-93.

A considerable decrease in the potato yield is, however, observed not only in the southern and southeastern regions of the Soviet Union in which, owing to the influence of high temperatures, a large amount (as compared with the northwestern regions of the country) of the potato yield has been observed left in the field every year. According to estimates of the All-Union Institute of Plant Protection, Phytophthora alone destroys two to two and a half million tons of potatoes annually, which in terms of money is equivalent to an annual loss of potato yield amounting to 7500 million rubles. Hence, we deem it appropriate to examine in the present article also the problem

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*[Droughts in the USSR, their origin, frequency and influence upon the yield], ed. by A. I. Rudenko.

concerning the influence of weather and climate upon the appearance of Phytophthora on potatoes which we developed in collaboration with the student, L. V. Gavriushenko [a woman] who is working for her diploma at the Leningrad Hydrometeorological Institute.

Of the many potato diseases, Phytophthora is the most widely distributed ~~one~~ and reduces the yield especially drastically.

In the Belorussian SSR, in years that are favorable for the development of Phytophthora, the decrease in yield [4] reaches up to 50%, and in the Leningrad Oblast' [4] up to 30%. Phytophthora (potato rot) is caused by a fungus from the Phycomycetes fungal group. Usually, the fungus attacks potatoes during the post-flowering period. At first, the disease manifests itself in the form of dark-brown spots that develop on all organs of the potato plant, with the exception of the roots. Later a mold appears in the form of a grayish-white film on the bottom side of the leaf. The injurious nature of Phytophthora has posed before specialists the task of developing Phytophthora-resistant potato varieties.

Phytophthora-resistance of varieties can, however, change under the influence of conditions under which the potatoes grow and [as a result] of the appearance of more aggressive biotypes of the parasitic fungus. Hence, along with the introduction of more resistant [potato] varieties, it is very important to begin treating the young crops with the corresponding chemicals prior to the

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appearance of Phytophthora. With this in view, the development of a sufficiently reliable forecasting method for the appearance of Phytophthora acquires great practical importance. A great deal of research of quite a number of scientists [3, 6, 7] has been devoted to the development of methods for the forecasting of the appearance of Phytophthora. Investigations in this realm applicable to conditions in the Soviet Union are, however, almost entirely absent. Meanwhile, a timely forecast of the appearance of Phytophthora in relation to weather conditions would permit initiating treatment of potato fields with the appropriate chemicals in good time, prior to the appearance of phytophthora visible to the naked eye, and, thus, avoiding great losses to potato growers. A detailed analysis of weather conditions in the different regions of the USSR for [the past] 22 Phytophthora years has enabled us to establish precisely what weather conditions are "critical" and precede the appearance of Phytophthora on potatoes. [Begin p.90]. Investigations conducted for the indicated 22 years of the daily course of air temperature, the relative humidity and data on precipitations during the period preceding the flowering of potatoes and the period following it have demonstrated that the initial appearance of Phytophthora on early potato varieties must be expected on the seventh-tenth day after in each of these days the following approximate complex of

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weather conditions had been observed for the preceding ten days:

1. Average daily [24-hour] air temperature from 15° up to 20°.
2. Maximal air temperature below 25°.
3. Minimal air temperature above 10°.
4. Average daily relative air humidity above 75°-80°.
5. Total precipitation about 20 mm and above.

Phytophthora can, however to a smaller extent, appear on potatoes also when [only] two factors favor its development: air temperature and precipitation, or air temperature and relative humidity.

The more precipitation of a continuing character falls during warm days, primarily in night time, and the higher the relative humidity of the air, the more rapidly and more intensively will the development of Phytophthora on potatoes proceed. One of the most effective control measures for Phytophthora is timely spraying of the potato field with the appropriate chemicals before the disease appears. Up to this time, a sufficiently promising method for determining in advance the best date for the initiation of Phytophthora control has been lacking. At the same time, only the early use of chemicals in Phytophthora control assumes the significance of a preventive measure. Hence, the proposed method pursues the objective of determining the best dates for the

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use of chemicals in Phytophthora control, and in so doing prevents its spreading on potatoes. However, to be able to judge as to whether or not Phytophthora will continue to develop after its original appearance, a weather forecast for at least the next five days is necessary. If the obtained weather forecast will predict that the weather conditions indicated above as favorable for Phytophthora will continue, then it will be necessary to take immediate measures of dusting and spraying of potatoes. If, however, the forecast indicates that the weather is expected to be unfavorable for Phytophthora for the next few days (for example, hot and dry), then prognostication of the date on which Phytophthora is to appear must be withheld and the character of the weather must be observed carefully in the days that follow. An example of the technique of compiling a forecast for the appearance of Phytophthora and of establishing the dates favorable for its development by means of calculating the average meteorological magnitudes for the preceding ten days is cited in table 3 for 1954 which was a bad Phytophthora year in the district [Begin p.93] of the Pushkin Laboratories of the Institute of Plant Industry. According to data by A. Ia. Kameron and G. S. Makiakova, Phytophthora in 1954 appeared on early potato varieties on the 3rd of August.

The climatic probability of the appearance of Phytophthora in the European part of the USSR has been established as a result

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of an analysis made of the course of weather conditions of each separate year covering the period from 1892 through 1953 for 31 meteorological stations that have a series of meteorological observations for many years (not less than 20 years). Weather conditions for the segment of time from June 10 through September 15 were analyzed for all years for each meteorological center, and were compared with ^a complex of meteorological factors favorable (critical) for the appearance of Phytophthora which we established. After the indicated analysis of weather conditions, the regions with one or another climatic probability for the appearance of Phytophthora on potatoes were determined. In the end result, the climatic probability for the appearance of Phytophthora in the individual centers on the European territory of the USSR was determined and a map (fig. 15) of the probable distribution of Phytophthora on potatoes was prepared. Because of the insufficient number of centers with years of daily meteorological observations, we have not as yet been able to establish the demarcation line of the probable distribution of Phytophthora from 60° of the northern latitude [s. sh.] northward, or in the western regions of the European part of the Soviet Union. It follows from fig. 15 that the greatest probability of Phytophthora appearance (over 75%) embraces the north-western part of the European territory of the USSR, i.e. exactly those regions in which the largest areas planted to this crop are concentrated. However, in the arid regions in

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the South of the USSR, Phytophthora occurs only in exceptionally rainy and cold years.

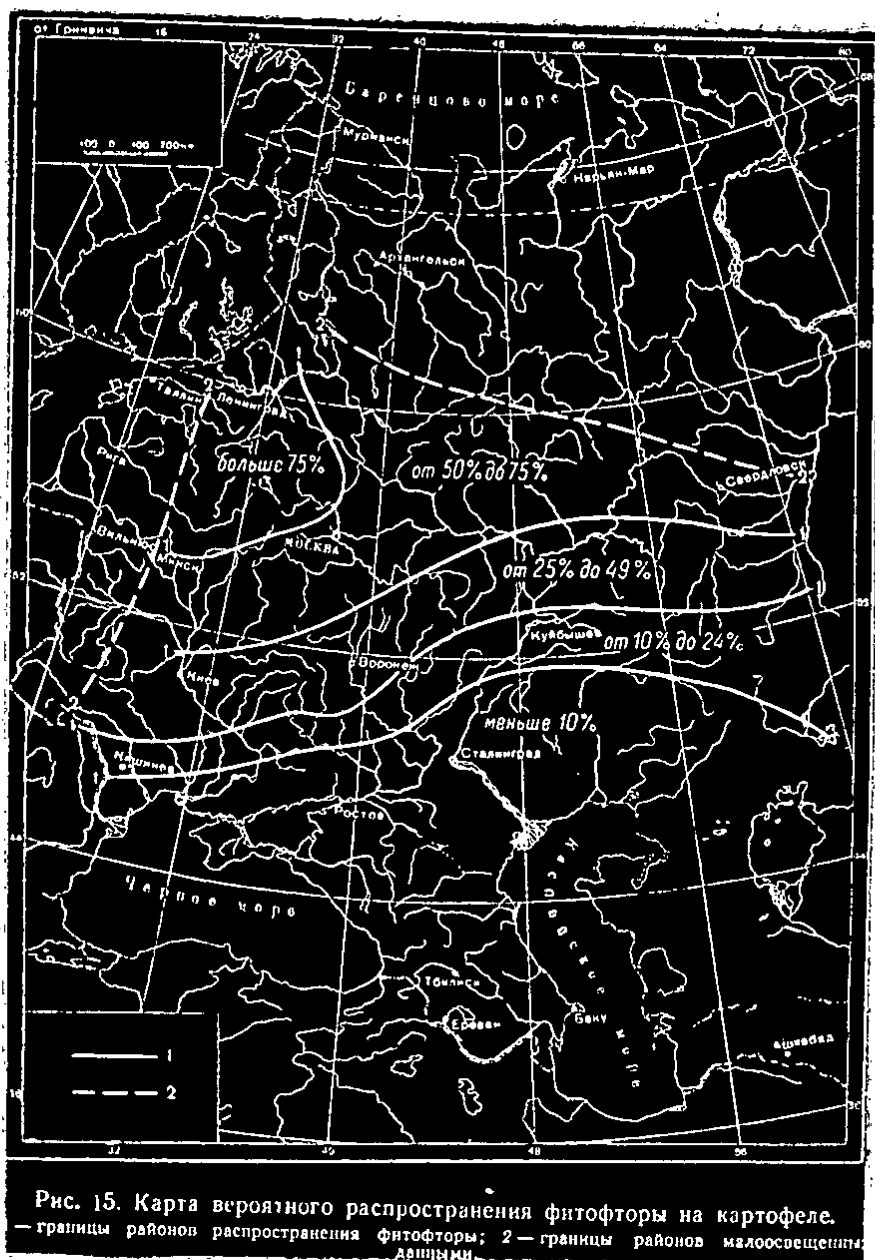


Fig. 15. Map of probable distribution of Phytophthora on potatoes. 1 - Demarcation line of regions of Phytophthora distribution; 2 - Demarcation line of regions lacking elucidating data.

Table 3.

Method of forecasting Phytophthora with the aid of an adjustable (sliding) meteorological table
(Phytophthora appeared on August 3rd) Pushkin, 1954

Date and Month	Sequence of days of weather favoring Phytophth.	Temperature of air									Relative humidity of air in %			Precipitation in mm		
		Daily average			Maximal			Minimal			Daily average			Total per day	Total for 10 days	
		Daily	Total for 10 days	Average for 10 preceding days	Daily	Total for 10 days	Average for 10 preceding days	Daily	Total for 10 days	Average for 10 preceding days	Daily	Total re-hu-midity for 10 preceding days	Average for 10 preceding days			
July 15		19.0			23.6			14.2			78				0.0	
" 16		17.5			21.2			13.5			76				"	"
" 17		16.0			20.5			9.1			70					
" 18		16.4			20.3			8.6			60					
" 19		17.5			21.9			14.6			84			18		
" 20		16.5			19.1			14.2			90			18		
" 21		16.4			21.0			12.2			79			0.5		
" 22		15.4			19.8			12.1			78			1.2		
" 23		14.9			19.3			9.1			79			5.5		
" 24	First	14.8	164	16.4	19.2	207	20.7	9.3	117	11.7	76	770	77	0.5	41	
" 25	Second	15.5	161	16.1	19.7	202	20.2	8.1	111	11.1	77	769	77	2	46	
	etc.				etc.			etc.			etc.			etc.		
" 26	Third	14.5	158	15.8	16.9	198	19.8	13.1	110	11.0	95	788	79	10.5	56	
" 27	Fourth	16.3	158	15.8	21.9	199	19.9	12.3	114	11.4	85	803	80	0.2	56	
" 28	Fifth	18.8	161	16.1	25.1	204	20.4	10.1	115	11.5	78	821	82	-	56	
" 29	Sixth	19.6	163	16.3	23.8	206	20.6	13.7	114	11.4	76	808	81	1.7	40	
" 30	Seventh	16.4	163	16.3	20.3	207	20.7	13.8	114	11.4	75	793	79	3.0	25	
" 31	Eighth	15.8	162	16.2	20.4	207	20.7	11.3	113	11.3	77	791	79	-	25	
Aug. 1	Ninth	17.9	164	16.4	22.4	209	20.9	8.9	109	10.9	76	789	79	-	23	
" 2	Tenth	16.1	166	16.6	18.6	209	20.9	14.2	115	11.5	88	798	80	8	26	
Aug. 3	Appearance of Phytophthora	16.4	167	16.7	20.0	209	20.9	13.7	119	11.9	80	802	80	0.2	25	

Trans. A-1067
(Table of con-
tents)
Jg/A

Kul'tura kukuruzy v SSR.

[The maize crop in the USSR]

Moskva, Sovetskaya Nauka"
1957 501p 59.22 K958

(In Russian).

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* In Russian: Volgo - Akhtubink.

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* A 11-Union Agricultural Correspondence [Courses]
Institute.

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Trans. A-1068
(Conclusions
only)
Jg/A

Shifman, I.A.

Metody i rezultaty gibridizatsii
form buroi rzhavchiny zlakov

[Methods and results of hybridization
of cereal leaf rust forms]

Leningrad. Vsesoiuznyi Institut Zashchity
Rastenii. Trudy, no. 10, p. 137-152.
1958 464.9 L542s

(In Russian).

Conclusions (p. 151)

1. Temperatures of 15-20° [C] are optimal for the germination of teliospores of Puccinia triticina and P. agropyrina.

2. In order to obtain normal germination of teliospores with the formation of basidiospores under any kind of temperature conditions, including optimal ones, a sharp change in temperature is necessary during their germination, from 20-25° down to 5-6° and conversely.

3. Infection of the aecidial host can be accomplished under conditions of teliospore germination with the formation of basidiospores. The more profuse the formation of basidiospores, the more intensive is the infection of plants.

4. Puccinia triticina crosses with P. agropyrina as well as with P. alternans forming a viable progeny that is either more or less aggressive, as compared with the original; there also develop forms with a changed group of susceptible plants.

5. Puccinia elymi West does not cross with Puccinia triticina or P. agropyrina, but crosses to some extent with P. alternans, which indicates a physiological estrangement of this species from rust fungi of the type of leaf of wheat.

6. As a result of hybridization, there develop physiological forms that are distinguished from the original ones by size of uredospores and teliospores; these differences sometimes are more pronounced than the difference in the sizes of specialized forms and of geographical races.

7. Puccinia triticina Er. et Henn; P. agropyrina Er. and P. alternans we consider merely specialized forms of Puccinia persistens Plowr.

8. The aecidial host of leaf rust of cereals is the place where hybridization of leaf rust forms is performed and the source of emergence of new physiological forms with changed aggressiveness.

9. We consider that for purpose of limiting hybridization of leaf rust forms, it is necessary to eradicate the aecidial hosts (Thalictrum, Leptopyrum) and also wild grasses near wheat fields as suppliers of crossing components.

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10. Hybridization, as a method, can serve the purpose of taxonomic subdivision of fungi, and ^{as} a phenomenon occurring in nature, it may be the cause of form developing processes.

The work was performed at the Laboratory of Mycology im. A.A. Iachevskii under the supervision of the head of the laboratory, Doctor of Biological Sciences, M.K. Khokhriakov.

Trans. A-1069
(Abstract and
Conclusions)
Jg/A

Shopina, V.V.

Roľ' predshestvennikov v izmenenii
porazhaemosti ozimoi pshenitsy
burci rzhavchinel

[Role of preceding plants in the
changed susceptibility of winter
wheats to leaf rust]

Leningrad. Vsesoiuznyi Institut
Zashchity Rastenii. Trudy, no. 10
p. 183-192 1958 1464.9515425

(In Russian)

Abstract

The importance of agrotechnics in the control of leaf rust on winter and summer wheats and the dissimilar influence of preceding plants upon the properties of soil and its regime are discussed. Some of them increase rust infection in wheat while others decrease it. A study was made of summer fallow, sunflowers, maize, newly plowed soil after alfalfa and rye grass and of cotton that had preceded wheat in crop rotations. Wheat varieties used in the study and dates on which leaf rust infection appeared are given in tables.

Changed nutrition of wheat determined by crop rotations was studied as a factor in leaf rust control. Changes occurring in

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the leaves of wheat under the influence of conditions of wheat growth were bound to produce a change also in the parasite. The decrease of leaf rust in different wheat varieties and the resultant productivity of the varieties have been explained and tabulated.

[Translation of] Conclusions (p. 191-192)

1. Susceptibility of winter wheat varieties to leaf rust under conditions of the Krasnodar Territory varies when grown after different preceding plants. When grown after individual preceding [Rotation] factors (summer fallow and cotton), wheat is attacked by leaf rust more severely than after sunflowers and maize.

2. The differences in the susceptibility of wheat to leaf rust correlate with the proportion and the quantitative content of potassium and nitrates in the soil during tillering - booting period of wheat. A change in the relation between these elements in the soil is reflected in the change occurring in their content in the leaves of wheat. [Begin p. 192].

3. Conditions under which wheat was grown after different preceding plants have a bearing upon the susceptibility of wheat to leaf rust the following year.

4. The influence of the after effect of the preceding plants is reflected in the productivity of the wheat and in the weight of the seeds.

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5. Changes occurring in plants under the influence of their cultivation after different preceding plants manifest themselves also in the change taking place in the leaf rust itself.

6. For the purpose of increasing leaf rust resistance in winter wheat varieties, it is recommended that seed plantings of this crop be allocated to a background that leads a variety directly to increased resistance and productivity.

Trans. A-1070
vg/A

Tumanov, I. I.

Pervyi god raboty Sovetskogo fitotrona.

[First year's work of the Soviet phytotron].

Akademiia Nauk SSSR. Izvestiia. Ser. Biol.
no. 2, p.265-282. Mar./Apr. 1959. 511 Sa2B.

(In Russian)

In the spring of 1957, the first round of the construction of a Station for Artificial Climate began to function. It consists of laboratories of a new type and abroad it is called a phytotron (Braak and Smeets, 1956; Bouillienne and Bouillienne-Walrand, 1950; Went, 1957). This phytotron permits making a study of the vital phenomena in plants on a background of external conditions as varied as the experimenter requires.

The Soviet Union is a continental country and, therefore, meteorological factors are of decisive importance to its plant industry. The quantity of the yield and the properties of a plant depend on the weather conditions prevalent in the different periods of the life of a plant. Our country is vast and its climate is varied. All of this prompts the Soviet physiologist to concentrate his attention on the external environment so as to be able to elucidate its influence upon plants. This is a

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difficult task. Under field conditions it is not easy to note the differences in the reaction of varieties and crops to climatic factors. The weather is extremely changeable and usually many factors exert their action upon plants simultaneously. Under such an experimental setup it is extraordinarily difficult to analyse physiological phenomena. [These conditions] gave rise to the thought of creating special, climatized light and dark laboratories in which it would be possible to maintain automatically any weather regime required by the experimenter's scheme. After surmounting great difficulties in designing as well as in building it, we created a complex structure which I described briefly earlier (Tumanov, 1957). Here, it suffices to point out that the climate [conditioning] machines installed at the Station are capable of producing 1750 tons of air of required quality per day [24 hrs] for experiments when they operate at full force.

In developing the structure of the first Soviet phytotron, we tried to utilize modern machine technique more fully for physiological work by adapting it to a study of the problems of national economy that are most important to our country. Now it is possible to regulate temperature and air humidity, to warm or cool the soil, to change the intensity and the character of light. It is not difficult to create soil and air droughts, or to expose plants to severe frosts. The erected experimental base permits rationing external conditions as regards their intensity as well as the duration of their influence. Apart from this, we are in a

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position to exert the action of one external factor or another upon a phase of the life of an organism of interest to us.

Besides climatic conditions, the fertility of the soil plays an important role [in the life] of a plant. Field experiments conducted with the application of fertilizers are insufficient for a study of the activity of roots, and physiologists have long since been growing plants on a nutrient solution of a very specific composition. Sand and aquatic cultures have been used successfully for this purpose, but in recent times a gravel medium has attracted attention. An attempt [Begin p.266] is being made to combine optimal mineral nutrition with adequate aeration of the root system by using this method. The gravel density is filled with a nutrient solution the composition of which is studied by repeating its circulation after specific intervals. The substrate can also be washed and later another, saline regime can be given. This installation permits changing within a wide range the root inhabited medium, according to the experimenter's will, as regards the relation of the nutritive elements within it, as well as the strength of their concentration, and, in addition to establish the characteristics of mineral nutrition of an organism during the different phases of its development.

Thus, the name of the described establishment - "Station of Artificial Climate" - is inaccurate. Here, it is possible to create not only diverse climate but also different fertility of the root inhabited layer. The experimenter strives to regulate

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nearly the whole external environment according to his own judgement.

In subjecting a plant to the action of certain climatic factors and in changing mineral nutrition and the water regime within a wide range, the physiologist brings about varied internal changes within [the plant] organism. Complex methods have to be used for their calculation. Lately some new methods have been proposed. Hence, the Soviet phytotron is being outfitted with modern laboratory equipment that makes it possible to utilize radioisotopes, mass-spectrometry, chromatography, electrophoresis, spectroscopy, electron and fluorescent microscopy, and cultures of isolated tissues and organs.

Climatizing represents an effective method not only for the study of individual physiological processes occurring within a plant, but also its reaction as an organism in its entirety. The phytotron permits creating special climatic and nutritive regimes for individual organs: roots, leaves, fruits and others at specific times of life. By observing the reaction of a plant under such conditions, it is possible to study more profoundly and to widen the theoretical conception of the mutual relationships between the different parts of the organism.

Thus, the newly created type of physiological laboratory is designated for a study of plant behavior: 1) under diverse climatic conditions, 2) with varying mineral and water regimes, 3) for an analysis of the mechanism of physiological processes.

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The Soviet phytotron provides conditions for a systematic, profound study of winter hardiness, drought resistance, salinity resistance, mineral nutrition and photoperiodic culture of plants. In accordance with the above, the laboratories of the profiles listed have been transferred to the Station. In the year 1957, forty four scientific workers and their staffs worked in this Station.

In the first year of work much time and labor was spent at the Station on adjusting the different machine installations, on assembling laboratory equipment, on developing and adopting methods and drawing up a systematic plan. Because the experimental base was not completely finished, it was impossible to conduct investigations on a full schedule. All the results obtained cannot be stated here, one can merely indicate the trend of the work and let the factual material obtained illustrate it.

Importance of Temperature Factor

The Soviet phytotron permits making a study of the influence exerted upon plants by a very large interval of temperature: at the present time work is already being conducted within the range of $+45$ to -195° . This section has many interesting problems: it is essential to know the optimal heat regime for the different varieties and crops at the different periods of their life; to establish the sensitivity of the principal species to frosts; to determine

their heat resistance; [Begin p.267] to elucidate the influence of specific temperatures upon the whole organism as well as upon its individual organs; to demonstrate the reaction of physiological processes to long term as well as to short term action of the heat factor.

Investigation of cold resistance of southern crops conducted by L. A. Mezgoverov and A. K. Solov'ev (1957) was continued. They made a study of the behavior of thermophilic plants at low positive temperatures and found that under these conditions injuries may be caused by two factors: 1) as a result of direct unfavorable action of cold upon cells; 2) as a result of root infection by pathogenic soil microorganisms. Death occurred sooner in the latter instance. Hence, the number of perished sprouts can be notably decreased by treating seeds prior to seeding, and, better still, by dusting the soil with fungicide dust, if, of course, exposure to cold did not last too long.

Viaznikov cucumbers perished almost completely after exposure to cold for one week on the usual soil, yet survived (fig. 1) when the preparation tetramethylthiuramdisulfide (0.5 gm per kg) was introduced in the soil. Positive results were observed also in cotton plants.

Fig. 1. Sprouts of Viaznikov cucumbers after a 7-day exposure to cold at 8-14° [C]. P - on soil treated with 0.5 gm trimethyl-thiuramdisulfide per kg; K- on soil with no fungicide

Good sprouts of maize were, however, obtained after a similar treatment of the soil.

A cold environment creates favorable conditions for root infection of thermophiles by pathogenic microorganisms not only during the germination period of seeds, but also after the appearance of sprouts. Hence, a fungicide treatment of the seed material alone cannot prevent a subsequent infection when the roots go down markedly deeper. For example, green pepper [bol-garskii (Eulgarian) perets] developed a normal root system after it had been exposed to cold on a soil disinfected with [the above] preparation. In the same soil the underground parts of a plant died off causing depression of the entire plant (Fig. 2) when pathogenic microorganisms were not eliminated. Root infection complicates the study of direct influence of cold upon thermophiles and this factor must be eliminated.

If low, positive temperatures exert destructive action upon crops sensitive to them, then they are not only safe, but [even] useful to cold-resistant species. To the latter these conditions are necessary in order to pass through their developmental processes. The study of vernalization [iarovizatsiia] of green plants and seedlings of biennials is still very incomplete. A. S. Krushilin clarified the optimal regime for root crops. Carrot seedlings pass through the first stage of their development the quickest at $+10^{\circ}$ and $+12^{\circ}$. In colder weather ($+1^{\circ}$ up to $+2^{\circ}$) vernalization proceeds more slowly. It proceeds successfully

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also when the [temperature] fluctuates between $+1^{\circ}$ and $+2^{\circ}$ which is often observed in nature in the change between day and night.

Lower temperatures are necessary also for the intensification of growth processes. [Begin p.268]. A study of conditions that contribute toward the advent and termination of the dormancy period is one of the Station's tasks. In the experiments conducted by N. A. Satsareva some tulips (of the Golden Harvest. [Gol'den Kharvest] variety) were planted at $+5^{\circ}$ and others at $+25^{\circ}$. The lower temperature accelerated the passing of the dormancy period in bulbs; in this case germination occurred 13 days earlier than under conditions favorable for growth. After 30 days the plants were transferred from $+5^{\circ}$ into a room with $+25^{\circ}$ where they soon blossomed out. The specimens left the whole time at $+5^{\circ}$ or $+25^{\circ}$ grew poorly and failed to flower.

The hardening of cells to frosts also proceeds in hibernating species at low, positive temperatures. A study of this phenomenon in winter crops was made difficult by the fact that similar experiments must be conducted in light. Under natural conditions, this is possible only in the fall and the spring. Yet, to obtain low, positive temperatures with sufficient light intensity in a laboratory is technically difficult. Therefore, T. I. Tranova and I (1957) jointly developed a method that permits hardening cereals in the dark. I had demonstrated earlier that in this case light was necessary for the accumulation of sugar by means of photosynthesis (Tumanov, 1931). Now, we have tried to enrich the tissues of

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winter crops with sugar by means of their entry from external solutions. Segments of coleoptiles the cells of which absorb sugar successfully from without proved convenient objects in similar experiments (Tumanov and Trunova, 1957). A week's maintenance of cut-off coleoptiles on a saccharose solution at 0° [C] was sufficient to enable second phase cells subsequently to pass through three days of hardening at temperature from -3° to -4°. After the described laboratory preparation, all coleoptiles in the winter rye Viatka were preserved up to -17°. The percentage of survived objects was determined by a method as reliable as the growth of coleoptiles after they had been thawed out.

Low temperature alone is not enough for a first phase hardening of winter crops because their cells must still be enriched by sugar. Coleoptiles pass through this process on the solutions of many sugars: raffinose, maltose and saccharose, less intensively on glucose and poorly on lactose. This difference is based on the dissimilar capacity of various sugars to accumulate in cells in the form of other protective compounds. Lactose, to be sure, does penetrate inside coleoptiles, but it does not stock up by conversion into other sugars. The glucose solution used must be osmotically stronger than that of saccharose, because only thus the cells obtain a sufficient amount of sugar. For saccharose, a 12%-16% solution is optimal. In tissues, the first phase proceeds worse on weaker as well as on stronger [solutions].

Since winter crops do not have a dormancy period, their growth processes weaken at the very time of their hardening (Tumanov and Trunova, 1958). [Begin p.269]. Analyses have demonstrated that in coleoptiles the content of free as well as of bound auxin decreases during the first phase of hardening. [The fact] that free auxins in cells influence their resistance to frost has been demonstrated by the deterioration of coleoptile hardening after an increased concentration of indole acetic acid (200 mg per liter) has been added to a 12% solution. The ability of cells to develop resistance depends also on their physiological condition. An important increase in frost resistance is observed only in young coleoptiles.

Fig. 2. Green pepper chilled for 13 days at 6-7°: P - in soil treated with 0.5 gm trimethyl-thiurem disulfide per kg; K - in soil with no fungicide

The station studied also the second phase of hardening. Northern tree species proved to be convenient objects for this purpose. Owing to the difficulty of producing very low temperatures in a laboratory, their resistance had remained practically uninvestigated. As a rule, they are not destroyed by frost under natural conditions.

First of all, the frost resistance of northern trees was elucidated experimentally by the natural hardening observed in the vicinity of Moscow. In the course of three years (1955-1957),

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A. A. Krasavtsev and I determined the resistance of the branches of birch, pine, oak, spruce, linden, apple trees and other species. In this case, their chilling in laboratory cabinets was begun with the temperature that was outdoors on that particular day, and it was conducted with a speed that eliminated a supplementary passing through the second phase of hardening. One-year shoots of birch, spruce and apple trees froze out in different seasons at drastically varying temperatures. In the summer they perished at -5° and -7° [C], yet in the winter birch and pine survive up to -65° , spruce up to -50° and apple trees up to -40° . In relation to weather conditions, the maximal frost resistance in the same species can reach different degrees. In birch, for example, it was -50° one year and -65° another year.

Attention has been attracted by the strong increase in the resistance of tree species at the beginning of winter and its sharp drop in the spring. In the first case hardening occurs at negative temperatures (second phase), but in the latter case there is observed a transition in cells from a frost resistant condition into a vegetative one. In winter crops, the second phase passes at comparatively slight chilling (from -3° up to -8°). Now, our experiments have elucidated that in northern trees this process continues even during severe frosts. These observations prompted [us] to begin a study of the hardening of resistant objects at different negative temperatures. It proved that frost resistance

in northern species developed during a gradual and slow increase in frosts.

The apple tree [variety] Grushovka Moskovskais freezes out at -40° after a hardening that is usual under the natural conditions of the Moscow vicinity. By creating a more favorable external environment in the laboratory for the second phase, it is possible to increase resistance in the branches of this variety to such an extent that after keeping them for 24 hours at -60° , their buds later open in the warm [atmosphere] and flower, although their wood had been slightly frozen (fig. 3). These objects survive even -100° , but sustain serious injuries. An even more striking frost resistance is obtained in birch when the second phase of hardening is regulated. [Egin p.270]. Its shoots die after lengthy tawing at -40° . Similar branches survived -100° after undergoing the proper preparation in a laboratory, and -195° with injuries (fig. 4). In a mild winter spruce was killed by frost at -30° , but its resistance was raised up to -100° when it received laboratory preparation, and with injuries [it survived] up to -195° . The survival of experimental branches has been demonstrated in our work by their capacity for subsequent growth.

The trees of the northern belt are capable of developing an unusually high frost resistance. After passing successfully the second phase of hardening, they survive not only the most severe frosts observed on the surface of the earth, but even considerably lower temperatures (-195°). Such an exceptionally high resistance

in tree species was obtained for the first time by laboratory hardening. By this means it was demonstrated that the objects used are indestructible by frost on the earth's surface. Their death during some winters is due to the fact that they were incapable of developing maximal frost resistance as a result of unfavorable external conditions that occurred during the preparation period.

Fig. 3. Frost resistance of the apple tree variety Grushovka Moskovskaya during the winter: left - after a supplementary laboratory hardening; right - without laboratory hardening

[Illustration shows] the apple tree Grushovka hardened up to -60° and in its natural state at -40°]

Now one can ask a theoretically interesting question: could a further search for optimal conditions for hardening increase the resistance of northern trees to such an extent that they would be capable of surviving even temperatures close to the absolute zero? Dry seeds and dried infusoria, algae, lichens, moss, and also the spores of bacteria and fungi are capable of it (Becquerel, 1950). In our investigations, however, it is a matter of obtaining the same phenomena in cells saturated with water which, undoubtedly, is considerably more difficult and has not as yet been achieved by anyone.

Under natural conditions, trees usually do not develop their potential record resistance due to inferior hardening at negative temperatures. Their sharp fluctuations produce an unfavorable

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effect. Even in Siberia where thawing is absent, [tree] branches warm up on sunny winter days considerably more than the air. In the evening, however, as a result of the rapidly proceeding cooling-off of the tissues, the cells do not have sufficient time to undergo hardening.

The data obtained about the tremendous importance of the second phase to northern tree species do not belittle the first phase. Branches cut-off at the end of summer and in the spring cannot be hardened successfully in a laboratory by the action of negative temperatures alone.

In making a study of the frost resistance in cells it is necessary to watch under a microscope how the freezing of tissues occurs. O. A. Krasavtsev (1957) designed a freezing stage on which sections can be studied at any temperature down to -80° (fig. 5). Liquid nitrogen poured out in Dewar vessels chills the copper strips which thanks to a high heat conductivity transmit cold to the sections lying in the chamber under the microscope. Temperature is taken on the stage with a thermoelement and is regulated by the immersion magnitude of the copper plates [plastinok] in the liquid nitrogen. This is accomplished with a device that permits raising and lowering Dewar vessels. To prevent formation of frost on the glass, the lens of the microscope and the chamber with the preparation are wrapped in a layer of cotton.

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Fig. 4. Frost-resistance of birch branches in the winter. Left -40° after long thawing; -100° and -195° after supplementary laboratory hardening [at -10° , -20° , -30° , -40° , -50° and -60°]

Fig. 5. Device for deep freezing (up to -80°) of the microscope table with liquid nitrogen

Fig. 6. Microscope stage being chilled by a brine current from a freezing installation

Fig. 7. Cells of a palisade parenchyma of a cabbage leaf examined through the epidermis: left - at room temperature; right - at -4°

The chamber designed by Iu. A. Samygin is convenient when work is conducted with lower temperatures. Its chilling is achieved with the brine current fed with a pump from the refrigeration installation (fig. 6). Fig. 7 shows a palisade parenchyma of a cabbage leaf before and after freezing (viewed from above through the epidermis). At -4° the content of the cells decreases sharply in volume and each of them is surrounded with a large amount of ice. When chilling occurs rapidly then ice forms inside the cells. Sometimes cells containing ice inside and adjacent ones without it are found in the same section (fig. 8). If the temperature is increased then the coalesced crystals are transformed into solid chunks of ice (fig. 9). [Begin p.272].

All the cells of an onion epidermis that had ice inside of them perished after it thawed out. Others preserved a red pigment: these had no ice within the protoplast and they survived.

At the present time very little is known about the life of plants in a frozen state. Under such conditions their biochemical

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processes are severely depressed, which ^{is} illustrated by [their] intensity of respiration. As determined by Z. G. Rakitina, respiration intensity of pine and birch branches that are immune to winter frosts decreases sharply at negative temperatures as compared with those during the summer. As frosts increase up to -22° , respiration intensity decreases to such an extent that it takes considerable time before the changes that have occurred in the composition of the surrounding air can be detected. Thus, during severe winters, our northern trees are for a long time in a badly dehydrated (by the formation of ice) condition with a poorly noticeable biochemical activity.

[Plate inserted between pages 272 and 273]:

Fig. 8. Epidermis of an onion bulb at -8° ; two cells were filled with ice, but the rest were not frozen

Fig. 9. Cells of a cabbage epidermis at -1.5° . Transformation of coalesced crystals into an unbroken mass at the relaxation of frost

A characteristic feature of overwintering plants is the enrichment of their internal atmosphere with carbon dioxide. Analyses made by Z. G. Rakitina have demonstrated that the CO_2 content within the shoots of fir was at different temperature as follows: from $+2$ to $0^{\circ}=4.6\%$; at $-6^{\circ}=13.1\%$; at $-20^{\circ}=19.3\%$. It can be assumed that an accumulation of CO_2 when frosts increase is obtained not only as a result of the increase in its solubility in water, but also as a result of encumbered diffusion of gases from the frozen

plant the protoplast of which is strongly condensed.

Investigations of heat-resistance conducted by Iu. G. Molotkovskii have demonstrated that bean shoots kept preliminarily for 12 hours on a 0.1 molar solution of ammonium nitrate died off when heated for three hours at $+42^{\circ}.5$, while controls were only slightly injured. [Begin p.273]. These experiments have demonstrated that it is possible for plants to die at high temperatures from selfpoisoning of cells with ammonia. Accumulation of the latter during heating has a toxic effect. Such injuries are not observed under normal conditions. With the aid of inhibitors, it was established that the respiration process exerts protective action and increases heat resistance in plants. When temperature is high, there occur unfavorable changes in nitrogen metabolism: an accumulation of nitrogen amines [aminnyi azot] is obtained by means of hydrolysis.

By the use of heating or chilling in special incubators, it is possible to make a study of the work carried out by the root system at various heat regimes. Experiments conducted by R. L. Vinokur have demonstrated that many southern forms grow in a warm root inhabited medium. Grapes and tomatoes, tobacco and pepper (fig. 10) and other crops produce more vigorous plants at a soil temperature of $+28^{\circ} - 30^{\circ}$ than at $+12^{\circ} - 14^{\circ}$. An elucidation has been initiated as to how the warming up of the root system contributes toward growth improvement of the entire organism. One of the many factors that exerts action in this direction is the influence of temperature upon the movement of mineral elements

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from the roots into the leaves. Experiments have demonstrated that radioisotopes of phosphorus (P^{32}) accumulate in the surface organs of a lemon that grows in warm soil in a considerably larger quantity than in cold soil (fig. 11). Another interesting fact has also been established. Radioisotopes of phosphorus enter the leaves and other vegetative parts even in warm soil many times more intensively in light than in darkness. Further it is contemplated to set up experiments [to test] the influence of the temperature factor upon the fruitbearing organs and to study by this means the effect of their warmth or chilling upon the magnitude and the quality of the yield.

Fig. 10. Influence of soil temperature: left - at 28° - 30° ; right - at 12° - 14° ; top row - grapes and tomatoes; bottom row - pepper and tobacco

Fig. 11. Influence of soil temperature upon the movement of radioisotope P^{32} from the roots into the tops of lemon shoots: at top - at 33° ; at the bottom - at 15°

Influence of Different Air Humidity upon Plants

Practical interest is aroused primarily by a study of the resistance of varieties and crops to dry winds. The action of this factor was exerted upon various objects in a greenhouse with a climate conditioner. In this greenhouse, wind was maintained for 10-12 hours with a 25-28% relative air humidity at a temperature of $+42^{\circ}$. P. A. Genkel' and K. A. Bogdanov have clarified experimentally the influence of pre-seeding hardening of seeds

upon the subsequent resistance of plants obtained from these seeds to air dryness. At first, the seed material swelled until it contained a specified amount of water and afterward it was dried out at room temperature within 36-48 hours. Erlana tomatoes grown from control seeds were badly injured by the indicated dry wind, yet those grown from treated seeds survived it well (fig. 12). An increase in the resistance to air dryness was obtained also in sunflowers and the maize Minnesota Extra [Minnesota Ekstra] from seed hardening.

The method proposed is effective in increasing plant resistance also to soil aridity. In this case a gravel culture and Knop's nutrient solution were used. [Begin p.274]. Drying of the root-inhabited layer was achieved by taking the gravel pot [vazon] from the lower dish containing the nutrient solution. Erlana tomatoes grown from seed that had been subjected to swelling prior to seeding and subsequently dried proved to be more resistant to soil dryness as well.

Influence exerted upon plants by gradation of air humidity that inhibits either growth or fruiting without any manifestation of injurious action continue to be inadequately investigated. 2. O. Zhurbitskii grew some tomatoes at a 50% relative air humidity and others at a 75% one. Fig. 13 shows that plants grown in a more humid atmosphere were considerably more vigorous, but the yield of their fruits was smaller (1100 gm); in a drier medium the growth of the surface portions was less stable, but the fruit yield was higher (1600 gm).

Fig. 12. Influence of pre-seeding hardening of seed material by P. A. Genkel's method for resistance of Erlana tomatoes to dry winds: left - controls; right - a plant grown from treated seeds

Fig. 13. Influence of different air humidity upon the vigor of tomato plants and their yield: left - plant grew at a 50% humidity; right - at a 75% relative air humidity. The columns show the size of the fruit yield

Analyses have demonstrated that at air humidity equaling 75%, plants assimilate more potassium and phosphorus but less nitrogen. Under these conditions the supply of fruits with nitrogen was poorer: they received only up to 40% of it, yet at a 50% relative air humidity - up to 60%. It follows from this experiment that a more vigorous development of the vegetative organs is observed in tomatoes growing in a damp atmosphere. Their dominant position within the organism impairs the growth of the fruits. Here, we encounter the reciprocal action between the vegetative parts and the fruit-bearing organs. [Begin p.275].

Influence of the Light Regime

Since the lighting installations have not yet been completed at the Station, it has been impossible to set up experiments for the elucidation of the influence of light intensity and light properties upon different plants. Different degrees of exposure to light can be obtained by changing the distance between the luminescent lamps and the objects. A more powerful current of radiant energy can be obtained by combining incandescent lamps with luminescent ones. An investigation of action exerted by the spectral

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composition of light upon growth, development and photosynthetic products holds out prospects. It has also been proposed that the importance of this factor be elucidated [with regard] to the hardening of plants to frost, for their entry into a state of dormancy and their coming out of it. Various sections of the spectrum are obtained by the use of luminescent lamps with different luminophores. Work conducted with intermittent light and a different length and intensity of the flash [vopyshka] is promising. In experiments with varying light, the physical aspect of the phenomenon (absorption of radiant energy by leaves) as well as the emerging physiological changes will be studied. Important work remains to be done in finding the optimal lighting regime for plants by means of selecting the proper sources of light required for the normal functioning of the phytotron as well as for a more successful use of light culturing in the practice of vegetable growing and floriculture.

The further study of the phenomenon of photoperiodism has prospects. Much has been done in analyzing the diurnal influence upon the blossoming of plants, but very little to elucidate the action of photoperiod conditions upon growth processes. In this sector, the role of this factor attracts attention when perennial, hibernating plants enter the period of dormancy and also when they come out of it.

Our experiments have demonstrated the summer diurnal influence upon the growth of many northern tree species: birch, Siberian acacia,

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larch and others. In a short (14-hour) photoperiod birch trees acquired the height of dwarfs, produced no branches and the leaves of seedlings fell off in the autumn. The same picture was observed on a Moscow day in nature, only their growth intensity was somewhat better. In one-year-old trees that had had the benefit of continuous lighting, the increment in growth surpassed the [year-olds] several times; many buds opened and formed secondary branches; seedlings grew till cold weather set in and retained their leaves.

Many species [grown] under long day [conditions] do not enter the dormancy period and, hence, usually freeze out during the winter (Moshkov, 1935; Iakusheva, 1945 and others). In our experiments, we determined the frost resistance of birch seedlings grown in different photoperiods. During the cold period of the year all variants were put under favorable conditions for the first as well as for the second phases of hardening, after which they were exposed to the action of severe frosts in freezing cabinets. It became clear that birch yearlings that had been kept under continuous lighting until cold weather set in were then capable of utilizing short autumn days with low positive temperatures. [Begin p.276]. These seedlings entered the dormancy period and, after their hardening, were capable of surviving -60° [C] without suffering any noticeable injuries. They were not exposed to more severe frosts: it was assumed that the yearlings will not survive even these frosts. Yet, after a short natural day and subsequent hardening, the birch seedlings survived -194° . A further study of the influence of

various photoperiods on the background of favorable and of cold weather promises to expand the theoretical concept on the processes that prepare plants for the winter.

Fig. 14. Dynamics of photosynthesis in cucumbers - under constant external conditions under luminescent lamps; on an overcast summer day

[Diagram shows, 1]: hours of exposure to light

[2]: time of day

[Vertical line]: mg CO_2 per dm^2/hour

Since the Station is capable of maintaining constant external conditions, it was interesting to trace the photosynthetic rhythm in an experiment of this type. N. H. Protasova set up corresponding experiments with cucumbers. CO_2 assimilation observed under luminescent lamps was more significant than that in the open on an overcast day in the summer. Regardless of the constancy of the external environment (lighting, temperature, air humidity) in a room where climate is conditioned, photosynthetic intensity continues to show notable fluctuations that decrease gradually (fig. 14). In the future, it will be necessary to trace the rhythm also of other physiological processes taking place in similar experiments.

Variation in Root Nutrition

Soil fertility of some type or other is of great importance in the life of plants. Hence the development of the physiology of an optimal regime for mineral plant nutrition continues to be

one of the fundamental tasks. The establishment of the characteristics of root nutrition for the principle crops is attracting attention. To select properly the time for and the composition of supplementary feeding, it is necessary to elucidate the requirements of an organism in nutrient substances during the different phases of its development. The effectiveness of fertilizers depends not only on the hereditary properties of varieties and crops, but also on the weather regime. Hence, it is essential to know the reaction of plants to any kind of root nutrition on the background of different meteorological combinations. These and many other problems can be studied by making use of the phytotron, in particular with the aid of the method of soilless plant culture (on gravel). This method is being used successfully in the Soviet Union by V. A. Chesnokova and E. N. Bazyrina (1957).

Growing plants on an inert medium with a solution of the necessary salts permits modifying root nutrition within a wide range. This offers a possibility of resolving problems of diagnosing leaves successfully and rapidly as to the requirements of young crops and plantings in any type of supplementary food.

A. F. Agafonova grew different varieties of tomatoes on gravel without transplanting them. Filling up of the substrate with a nutrient solution was carried out with a pump twice a day [24 hours]. Under these conditions the tomatoes grew well. In connection with the development of a method for gravel culture, A. F. Agafonova made a study of the importance of various forms

of iron for beans and spinach when added to a nutritive solution. Iron chelated [khelestirovannoe] with ethylene diamine-tetraacetic acid is more favorable than chloride or citrate, especially in an acid and alkaline reaction of a medium. Chelated iron moves within a plant with relative ease. Analysis has demonstrated that the mineral form of iron (FeCl_3) and in a considerable measure the citrated one accumulate primarily in the roots, but the chelated one penetrates in large amounts into the leaves and stems. In the latter case the surface mass and the root system developed better and chlorosis was absent.

The growing of plants on an inert medium permits unfolding the study of their salinity resistance more widely, since heretofore it was difficult to control the qualitative composition of a soil solution. The Station is equipped to elucidate [Begin p.277] the action of various types of salinity upon different plants, of chloride, sulfate, carbonate and their various combinations. The problems arising [in this study] include: the importance of salt concentrations, the duration of their action, the sensitivity of an organism to the salts during the different stages of its life, the character of the after effect when put on normal root nutrition. Further, it will be necessary to elucidate the salt-resistance in plants under different climatic regimes, for example, on a background of high soil and air temperature, and under different [degree of] dryness of the latter. If the variations listed were accompanied by corresponding tissue analyses, then it would be

possible to penetrate deeper into the organization of the life of varieties and crops under the indicated unfavorable characteristics of the root-inhabited layer. The development of methods for a diagnosis of the degree of salinity as well as of plant sensitivity to it is of importance to practice, as is a search for means of increasing the resistance of seedlings and plantings.

B. P. Stroganov made a study of the influence of various types of salinity upon cotton and found that they cause unique morphological and anatomical changes in the organism. Fig. 15 shows that the smallest possible cellular [kлетnos] (xeromorphic) structure is found in cotton with [an excess amount] of sulfate salts. An epidermis is distinguished when it contains chloride: here the cells are very large with an increased content of water, but the conducting system is poorly differentiated. The intermediate position is held by the epidermis of the variant on a fresh water [na presnom] background.

Fig. 15. Epidermis of cotton leaves with different types of salinity. Left - on a fresh-water background; center - with sulfate; right - with chloride

[Illust.]: Controls Sulfate Chloride

Fig. 16. Influence of 1% soil salinity upon cotton. From left to right: 1 - controls; 2-- sulfate; 3 - carbonate; 4 - chloride salinity

The solutions under study exert specific action not only upon the external appearance of a plant and its structure, but they lend originality also to physiological functions. Chloride salinity

inhibits the growth and the accumulation of dry substances more intensively [Begin p.278] than the sulfate one (fig. 16). Since, in the latter case, cell growth decreases drastically (small-celled), chlorides, obviously, decrease sharply the division and differentiation of cells, and sulfates - their growth. In the first instance plants possess a lower transpiration intensity than in the second instance. Water absorption in chloride salinity is provided by the increased suction power of the cell as a result of the increase [obtained] in the osmotic pressure of cellular juice, but in sulfate [salinity] it occurs as a result of a better developed root system and conduction paths. A further profound study of the influence of various salts may not only reveal the resistance mechanism, but it may even obtain important data on cell physiology, improve the knowledge of growth processes and enrich our conception of biochemical conversions.

Cultivation of Isolated Organs and Tissues

One of the methods used in a study of physiological functions is the culturing of cut off organs and tissues (Eutenko, 1956; Smirnov, 1956). This method was used earlier in the Soviet Union in individual investigations, but systematic work had not been conducted. A. M. Smirnov (1956) managed at the Station to obtain sterile cultures of continually growing isolated roots of a series of plants: tomatoes, carrots, spring vetch, red clover and alfalfa on the condition that they were transferred every week to a fresh

nutrient solution. In other species: cereals, many tree species, and ginseng [*Panax ginseng*] growth ceased and cells died off after several transplantings. At first they lost their capability to divide at the tips of the main roots; then it became necessary to utilize the secondary ones.

The daily increment in an alfalfa root was 40-50 mm. Within 16 days the length of the root increased 10 times as compared with the original size (fig. 17). It was established that molybdenum had a stimulating effect upon the isolated roots of vetch, clover and alfalfa. Replacement of iron sulfate with citrate in the nutrient liquid improved the growth of this organ.

The external nutrient medium undergoes notable changes under the influence of the physiological activity of roots. As a result of its selective ion absorption its reaction shifts in an alkaline direction (pH from 4.6 up to 5.5). Under the influence of extracellular enzymic activities of tomato and alfalfa roots, there appear reducing substances within the external solution.

Fig. 17. Growth of an isolated alfalfa root in a sterile nutrient solution: left - original tip of a root; right - the same root after 16 days of culturing

The secretory function of the root system has been inadequately investigated. In connection with this circumstance, the reciprocal action occurring between the isolated roots of different species must be elucidated by means of culturing them

jointly under sterile conditions. The study of the symbiosis between legumes with nodule-forming bacteria must be expanded. [Begin p.279]. Important work must be carried out on an analysis of the effect of various physiologically active substances: gibberellic acid, stimulants and inhibitors of growth, vitamins etc. Much [research] remains to be done before [we] shall be able to understand root assimilation of organic forms of phosphorus, nitrogen and other complex compounds. An elucidation of the influence of various external conditions will help to discover the changes occurring in the activity of roots and in their adaptation to the surrounding environment.

Methods of sterile culturing are being used also in work conducted with the whole organism. A. M. Smirnov (1958) demonstrated that alfalfa shoots contain insufficient carbon. He increased sharply the vigor of the root system (fig. 18) in this plant by adding 2% saccharose to sterile agar. Obviously, the extremely slow growth of alfalfa following its seeding, when it is readily stifled by weeds, can be explained by the small carbohydrate reserves in the seed.

It is desirable that the method for sterile culturing of isolated tissues be used more extensively so that problems of the biosynthesis of alkaloids and many other substances can be resolved. M. S. Bardinskaja studied the lignification processes of cell membranes by this method. Besides being theoretically interesting, the lignification deposit within them is of practical

importance: "maturing" of the wood of fruit crops is connected with their better preparation for the winter, while lignification of haulms increases the resistance of cereals to lodging. In experiments conducted with isolated calluses of carrots it was possible to obtain an increase in the amount of lignin by introducing into the external culture medium one of its precursors: glucoside of coniferin. The increase in lignification is demonstrated by microchemical reactions; [Egin p.280]; it is accompanied by an increased increment of dry substance (fig. 19).

Fig. 18. Influence of 2% saccharose added to agar upon the growth of the root system in alfalfa shoots: left - without saccharose; right - with saccharose

Fig. 19. Growth of a callus isolated from a carrot: upper - control; lower - when glucoside of coniferin was added

The method for culturing isolated tissues is used widely in the study of growth processes and cell differentiation phenomena. R. G. Butenko [a woman] (1956) conducted experiments with calluses of carrots, wild grapes and Jerusalem artichoke. They were grown on agar under constant under constant external conditions (temperature 26° [C], air humidity 70%) in different nutrient media: that of White [Uaita], Geller and Nitsch [Nicha]. The best results were obtained from the latter mixture; it is distinguished by a large potassium and nitrogen content. The length of time the callus was grown between transplantings was 1.5 months.

Three types of calluses were propagated for experiments and study: 1) a normal one, i.e. one that requires that auxin be added to the nutrient medium; 2) the root-knot (gall) type that grows without an auxin additive, and 3) "the adapted" ["priuchennyi"] type that evolved intermittently from the normal one and is distinguished from the latter by its ability to synthesize auxin. Interest has been aroused by "the adapted" ["priurochennyi"] callus of carrots (Gautheret's clone) that has been growing continuously in an isolated state for 20 years (fig. 20).

Fig. 20. Adapted callus of a carrot root (Gautheret's clone); cultivated in an isolated state for 20 years

A clearly pronounced seasonal periodism has been noted in the growth of calluses. Regardless of the constancy of conditions in a room where the climate is controlled and the uniformity of the food, the most intensive growth processes have been observed in the spring and at the beginning of summer; they proceed at the slowest pace between November and January.

A continuous increase in the dimensions of a callus cannot always be obtained; in carrots, for instance, there sometimes appear on it roots, but in the case of chicory a whole plant can be obtained from it.

The different relation of calluses to temperature has been clarified. In carrots their growth stops from $+5^{\circ}$ to $+8^{\circ}$, but they are preserved under these conditions for a period of 3-4

months. Later, having been transferred to an optimal heat regime, they intensively increase in size and no necrosis is found in their tissues. Yet, calluses of wild grapes not only cease to grow at the indicated decreased temperatures, but they completely perish within a month. In light, the size of a callus increases more slowly.

A study was made of the effect of many physiologically active substances upon the growth of calluses; triiodo-benzene acid, adenine, gibberellic acid, indole acetic acid, maleic acid hydrazide, sodium ethyl-xanthogenate, coconut milk etc. From the results obtained it can be noted that adenine stimulates the formation of buds, but their shoots are different. Some concentrations of maleic hydrazide inhibit growth up to 5.5 months and others provoke necrosis.

There is reason to anticipate that the method for culturing isolated organs and tissues will be used in the future even more extensively. It permits eliminating correlative reciprocal relations between different organs, elucidating the influence of different substances upon plants by means of entering the cells from the external environment, and it offers a possibility of growing the objects under investigation in an external environment at a specific nutritive regime controlled by the experimenter. [Begin p.281].

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Future Tasks

The statement of the results obtained has indicated and substantiated the trend of the physiological work conducted at the Station. All of the work was carried out on a background of extensive variation of the factors of external environment: temperature of the air and the soil, degree of atmospheric dryness, intensity and properties of light, length of day, mineral nutrition and water regime. A few things must be added to the above-said.

Interesting data can be obtained in making a comparative study of the physiology of seed germination in thermophilic and cold resistant species. Pre-seeding treatment of seed material practiced as a method of exerting action upon the rudimentary organism has been attracting increasing attention.

Facts already available permit anticipating substantial results from a study of thermoperiodism. Here, it will be necessary to disclose the characteristics of this phenomenon in different types of plants and to understand its physiological mechanism.

Heretofore, the attention of researchers was centered chiefly on the transition of the organism from vegetative growth to generative development. The second important half of its life - from flowering up to maturing - continues to be poorly investigated. In this section there arise many problems connected with fertilization, setting of fruits, the growth of the latter and with pro-

found biochemical changes occurring within them during maturing. In exerting the influence of various external factors upon the whole organism as well as upon its individual parts at this stage of its life, it is essential to extend the study of the physiology of deposits found in the reproductive organs of carbohydrate, protein and fat reserves, and to establish the conditions determining the magnitude and quality of the yield.

Physiologically active substances (stimulants and inhibitors of growth and others) do not always produce similar results when their action is exerted upon plants: their influence is changed notably by conditions of external environment. Hence, it is desirable to trace their action during different weather regimes and to try to find more effective methods for the use of these preparations in practice. Such an approach promises a more varied understanding of the role and the mechanism of physiological changes when specific chemical compounds are introduced into the organism.

Apart from a general analysis of vital functions, the phytotron creates the required conditions for the development of a partial physiology of plants as well. Available devices permit establishing economically important characteristics in varieties and crops, elucidating their behavior under various climatic conditions and on the background of varied soil fertility. It is desirable that this work be conducted by physiologists in conjunction with breeders and agrotechnicians having centralized

it in branch institutes and at experimental stations in which phytotrons probably will arise in the near future.

To accomplish this, one of the tasks of the Station is the setting up of rich, modern techniques to serve the science of plant industry. This work is conducted in conjunction with the engineers and its objective is the designing of new installations and apparatuses. For example, during the period reported, the Station has designed an installation that is to determine frost resistance of fruit trees during the winter directly in the orchard. A similar structure can be created for the purpose of determining the resistance of winter crops and perennial grasses in the field. On the basis of the experience obtained, more simple and less expensive climate machines suitable for the solution of practical problems at plant industry experimental establishments and to aid the latter in setting up research work will have to be developed in the future. Interest in the phytotron is widespread in our country. It suffices to say that within a year's time the Station has given advice to 25 scientific establishments on the construction, [Begin p.282], the designing and the work of climate, refrigeration and other installations.

It is obvious, from all that has been said, that the phytotron represents a good experimental base. It permits developing systematically problems that heretofore could not be brought up because of the absence of the corresponding material circumstances. The available equipment permits, within a comparatively short time,

investigating many complex biological phenomena occurring within the plant organism. This offers a possibility of forming a clear idea regarding the behavior of plants in a more complex field setting with various combinations of climatic as well as soil conditions, which facilitates the solution of the practical problems arising in plant industry. Because of the importance of the described new type of laboratories, one can't help anticipating that the building as well as the equipping of the first Soviet phytotron be completed at the earliest possible date.

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Coordinated conference on problems of scientific research work in the sphere of feed for agricultural animals.

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(In Russian)

On December 23 and 24, 1958, a Conference was held at the All-Union Scientific-Research Institute of Animal Industry; it summed up the results of scientific-research work, as well as outlined the basic trends for research in the field of feeding of agricultural animals. The Conference was opened by the Corresponding Member of VASKHNIL [All-Union Academy of Agricultural Sciences imeni V. I. Lenin], M. F. Tomme.

N. A. Staroverov, who addressed the meeting in the name of the Ukrainian Academy of Agriculture, [Begin p.145] said that in the Ukraine, in order to increase proteins in the rations of agricultural animals, corn was planted together with soybeans and lupines. This mixture was given to the cattle as green additional ration. Along with this, corn is ensilaged with leguminous plants in the presence of organic and inorganic compounds of nitrogen. Milk yields of cows have increased as a result of feeding corn silage, prepared with ammonium sulfate. Interesting results were obtained in experiments of artificial drying of soybeans, alfalfa, carrot and beet tops, as well as carrot roots. Storage of dried plants in a ground form is the most effective

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in paper bags. For instance, the losses of carotene did not exceed 40-50% in storing dried carrots. N. A. Staroverov expressed a wish about the necessity of formation of a single method for determining the digestibility of fodder.

V. A. Sapunov (Belorussian Institute of Animal Industry) reported that two complex stations of the Institute study the lupine as a source of plant protein. Lupine is ensilaged and used (as a green feed) in a pure form and in mixtures with peas and oats; this produces especially good results; the experimental swine stepped up the weight increases, the milch cows increased milk yields when they were fed carbamide (urea). In concentrated rations 100-120 g of carbamide replaced the digestible protein. Good results were obtained, in swine fattening, by replacing 100 g of proteins with penicillin mycelium. Studies of hydrolysis were conducted on milch cows. The milk yield of cows increased by 300-400 g per day when 3 kg of hydrolyzed and yeasted straw flour was added.

Professor N. I. Zakhar'ev (Kirghiz Scientific-Research Institute of Animal Industry and Veterinary Science) reported that in 1958 experiments were conducted in the Institute on the enrichment of corn silage with alfalfa. Plantings of peas and soybeans, as a source of high protein feed for young animals, are very promising under conditions of the republic. The effectiveness of mixed plantings of barley and of vetch is being studied. In the Kirghiz Institute of Animal Industry plants are being studied from the point of view of their content of iodine and

strontium; ensilaging of corn and sugar beet tops is being conducted; experiments are conducted on ensilaging of corn stalks, tops of sugar and fodder beets; of corn and alfalfa.

Professor A. P. Dmitrochenko (Leningrad Agricultural Institute) pointed out in his report that observations, conducted by him, gave him reason to make a conclusion that the digestibility of proteins of different degrees of solubility is similar, but their absorbability is dissimilar; their effect on the organism of the animal is unlike also. Oil cake infusion in 1% salt solution was used in feeding the calves. Observations of the microbic process in the rumen have shown that the presence of ketone bodies in milk pointed to the disturbance of fermentation processes in the rumen.

Professor D. V. Elpat'evskii (Saratov Zooveterinary Institute) reported that at the Institute much attention is paid to the development of feeding norms for large cattle, horses and swine. A method of digestibility of feeds in vitro has been established, as well as in animals. Experiments were conducted on free [unlimited] additional protein and mineral feedings, which gave good results. Experiments were conducted on free feeding of trace elements. A method of chemical treatment of straw with alkalies (in the course of 7-10 days) was developed at the Institute; in such cases the physical structure of the cellulose was changed and its food value increased.

V. V. Alipov (South-Eastern Institute of Agriculture) ac-

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quainted the Conference with results of experiments of feeding a mixture of corn and soybeans (mixed planting), which gave negative results, since, apparently, in mixed plantings the contents of proteins were reduced in corn in connection with its inhibition. The conclusion was made that in mixed plantings it is necessary to carefully choose the components for the mixture. Experiments were conducted on feeding carbamide to milch cows (100 g of carbamide replaced the oil cakes) for the enrichment of the ration with nitrogen, as well as adding carbamide to the corn silage. Experiments were conducted on feeding poultry with hydrolyzed yeasts; they gave positive results.

L. A. Shchetinov reported that Omsk Institute of Agriculture conducted experiments on utilizing protein of animal origin. For instance, lake crayfish - "gammalus" [gammarus?] (source of protein) was used in fattening of over 80 thousand ducks and over 24 thousand chickens.

P. T. Tribulkin mentioned that in experiments, which were conducted in Sibirskii Scientific-Research Institute of Animal Industry, plants were included into the rations of large cattle, in particularly, soybeans, containing protein in large amounts, in order to increase the level of the protein feeding. In 1957, 10 to 15 c of protein and 3-6 c of digestible protein were contained in the harvest, obtained from one hectare (2.471 acres) of green mass of soybeans, as the analysis has shown. When feeding silage to cows, which was made of a mixture of corn and of

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leguminous plants, the milk yields increased by 12%. Good results were obtained in fattening of swine with a combined silage (potatoes, root vegetables and grain wastes).

Professor V. N. Bukin (Institute of Biochemistry of the Academy of Science of USSR) reported that vitamin A (synthetic) is successfully used in poultry industry and swine breeding. It is recommended [Begin p.146] to be given in the form of dry preparations, and not as an oil solution. Observations have shown that 40 g of B₁₂ and 40 g of biomyacin are sufficient for enriching a large amount of feeds.

Professor M. F. Tomme pointed out that works, conducted by VIZH [All-Union Livestock Breeding Institute], have shown the possibility of partial replacement of protein feeds with carbamide. Six combined feeds were developed, which are being utilized in growing and fattening of young animals (together with large givings of silage).

According to the report of Professor M. Ia. Berginia, the Latvian Agricultural Institute developed a prescription for enrichment of [feed materials] with vitamins and mineral substances for "lizuntsy" [animals which lick]. At the present time experiments are conducted on early weaning of piglets, on feeding to highly productive cows and swine of a mixture of trace elements (salts of zinc, manganese, boron, iron, cobalt, iodine, and so on). In view of the fact that, in the preparation of flour from fish wastes at a temperature of 130°, proteins and other valuable

nutrients are lost, the Institute suggested to conserve fish wastes without a hot treatment, but to place them into a vacuum apparatus and after that to prepare from them a fish paste at 40°, which contains 50-58% of dry substances, 38-40% of protein and can stand a long storage. Swine eat this paste with pleasure, as well as the fish flour prepared by the same method.

Professor N. A. Shmanenkov and G. A. Magidov (All-Union Institute of Horse Breeding) acquainted the Conference with the results of chemical preservation of feeds, with production of dry preparations for preservation (obtaining a sweet silage without a reduction of pH), utilization of carbamide, use of biomyacin and vitamin B₁₂ in growing of colts. It was mentioned that phosphates improve mineral metabolism, growth and development of young animals, increase nitrogen metabolism of mares in foal.

N. K. Alekseeva (Uzbek Academy of Agricultural Sciences) reported that in the republic cottonseed cakes, with an addition of mineral substances, are being used as animal fodder. "Dzhugara" [a variety of sorghum], which produces 1.5 c of green mass from 1 ha, is being studied. I. I. Khutsishvili (Georgian Institute of Animal Industry and Veterinary Science) imparted a prescription for a combination feed into which enter wastes of the fruit industry, of meat combines, fish wastes, dry press and cocoons of mulberry silkworms. Honored Scientist, Professor P. P. Berezhnaisa (Kishinev Agricultural Institute), reported that in Moldavia

the protein problem is being solved by means of expansion of plantings of alfalfa, of corn, of soybeans, chick-peas, vetch, dolichos (kidney beans) and peas.

Professor I. M. Kuznetsov told about his impressions about travels to foreign countries. In Holland, Belgium, Denmark and England types of feeding are being developed, on the basis of which rations are formed suitable to individual kinds of animals, zones, types of farms, and so on. In Holland, at the present time, more attention is paid to the contents of proteins in milk and not to the fat content. In foreign countries, "provims" - combination feeds, containing proteins, vitamins, mineral substances, and so forth, are now used on a large scale. Great importance is attached to copper, not to cobalt; to its effect on milk production.

According to data of Professor N. I. Ionov (VIZH) wastes of the mycelium of antibiotics can be used for the enrichment of feeds: 2-3 kg of dry wastes are sufficient for enriching 1 t of concentrated feeds. Use of blomycin raises (by 16.6%) the increases of weight of swine during fattening. Terramycin produced a better effect on animals.

In his report "Theoretical elements of ^{feeding} agricultural animals", Academician I. S. Popov acquainted the Conference with the project of topics for scientific research, developed by VASKHNIL for the next few years, where means are planned for the coordination of work of scientific institutions on this problem. In drawing

up the plans, VASKHNIL took into consideration the degree to which each problem was studied, as well as demands of the national economy.

This project includes seven most important subjects: 1) Protein feeding of agricultural animals. The practical realization of this subject, comprising several subordinate topics, was entrusted to VIZH, TSKHA [Timiryazev Agricultural Science Academy], Moscow Veterinary Academy, All-Union Scientific-Research Institute of Horse Breeding, All-Union Scientific-Research Institute of Fodder, All-Union Scientific-Research Institute of Poultry Industry, All-Union Scientific-Research Institute of Swine Husbandry, "VNIOK" [VNIIOK (All-Union Scientific Research Institute of Sheep and Goat Breeding)], SibNIIZH [Siberian Scientific-Research Institute of Livestock Raising], Scientific-Research Institute of Livestock Raising in the Forest-Steppe and Woodlands of Ukrainian SSR, Ukrainian Academy of Agricultural Sciences, Academies of Allied Republics. 2) Basic elements of production of combined feeds. Fulfilment of this subject, which includes 5 problems, was entrusted to VIZH, All-Union Scientific-Research Institute of Horse Breeding, All-Union Scientific Research Institute of Swine Husbandry, All-Union Scientific Research Institute of Poultry Industry, Ukrainian Academy of Agricultural Sciences, and Siberian Scientific Research Institute of Livestock Raising. 3) Vitamins in group B in the feeding of swine and poultry. Development of this subject was entrusted to VIZH [All-Union Livestock Breeding Institute], together with the All-Union Vitamin Institute and the Institute of

Biochemistry. 4) Trace elements in the nutrition of agricultural animals. Executors of the subject - VIZH, Moscow Veterinary Academy, VNIIC [All-Union Scientific Research Institute of Horse Breeding], Latvian Institute of Animal Industry, Ukrainian Academy of Agricultural Sciences and the Siberian Scientific-Research Institute of Livestock Raising. 5) Studies of microbiological and biochemical processes in rumens of the ruminants as a basis for developing technical methods of improvement of utilization [Begin p.147] of bulky feeds. Executors of the subject - TSKHA [Timiryazev Agricultural Academy], Moscow Veterinary Academy, Ukrainian Academy of Agricultural Sciences, VIZH and the corresponding Chairs of higher institutes of learning. 6) Working out a new system of evaluation of the nutritive value of feeds. Executors - VIZH, Leningrad Agricultural Institute, Ukrainian Academy of Agricultural Sciences. 7) Raising of the maturation of meat animals - swine and poultry - by the factors of feeding. This subject will be worked out by the organizations, which are engaged in fattening of animals and poultry.

N. K. Florenskaja, Professor M. F. Tomme, Professor A. S. Solun, N. A. Staroverov, Professor D. V. Elpat'evskii, P. V. Demchenko, A. I. Fetisov, Professor A. A. Zubrilin and others took part in discussions of the report of Academician I. S. Popov.

Development of working plans and methods on the suggested subjects was entrusted to special commissions.

(Signed) L. F.

Vershinin, P. V.

Ob iskusstvennykh pochvennykh strukturoobrazovatel'akh.

[Synthetic soil structure conditioners].

Pochvovedenie, no. 10, p.28-37. Oct. 1958. 57.8 P34

(In Russian)

The term synthetic structure conditioners implies primarily organic compounds that improve water stability of soil structure when introduced into the soil. The idea of synthetic soil structure conditioners was conceived in the USSR in the year 1932 and is associated with the names of A. F. Ioffe and D. L. Talmud.

We have already reported (5) that the preceding historic works on artificial structure conditioning were the experiments conducted by Fadeev and Vil'iams [in an attempt] to create a water-stable structure by means of introducing humic substances isolated from Chernozem soils into a soil-and-sand mixture.

The new ideas on synthetic structure formation were based on the premise that water stability of soil structure can be brought about by means other than merely humic acids (10).

At the All-Union Conference on Soil Physics held in 1934, the author of the [present] article (2) made the first reports on experiments conducted in synthetic structure formation on new

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[Agrophysical Scientific Research Institute, Leningrad]

principles, but they were not successful among soil scientists. The Agrophysical Institute, however, continued the work begun. Various organic compounds were studied with a view toward utilizing them as [soil] structure conditioners before the Great Patriotic War broke out. The fundamental requirement made of substances of this type was solubility in water, penetration into the soil, entering into reciprocal action with it, converting into an insoluble state, and, in so doing, be adsorbed by soil particles, and impart into lumps of soil the properties of water stability.

These conditions were met by the most diverse substances.

Cellulose. The technical product - xanthogenate of cellulose (viscose) - $(C_6H_9O_4OCSSN_x)_x$ representing a viscous liquid and freely soluble in water was used in experiments. Pure quartz sands of varying dispersity (0.5-0.005 mm) were given complete structural form by the water dissolved viscose, and they acquired the properties of water stability (2). Under the influence of viscose, podzolized, structureless soils acquired the water stability of ordinary, virgin, clayey Chernozems in various degrees. The increment in oat yield on experimental field test plots increased sharply as compared with mineral fertilizers (6).

Hemicellulose. Of the hemicellulose [group] xylan was tested. Xylan was obtained by Sal'kovskii's method. In specimens of sod-podzolized clayey soils ground into a powder and treated with xylan jelly, the water stability of the [soil] aggregate did not increase as compared with the aggregates obtained with the aid of water,

even through xylan gels well and imparts high mechanical stability to soil particles. This fact can be explained by the great water solubility of xylan. Introduction of considerable doses of lime into soil treated with xylan decreases the solubility of xylan and thus enables the soil clods to acquire water stable properties (9).

Lignin. The lignin tested was obtained by the Bekman and Lishe soft method because it was assumed that lignin isolated by strong acids [Begin p.29] changes essentially and resembles very little the natural kind. By this method lignin is obtained either by extracting the fiber [solomy] with a two percent alcohol solution of sodium hydroxide, or by extracting with 1.5% NaOH with the subsequent elimination of carbohydrates by boiling with 2-2.5 HCl , or by means of precipitation with methyl or ethyl alcohol. When such lignin is air dried it turns into a powder that is insoluble in water. It was introduced into the soil in a one percent solution KOH . Specimens of sod-podzolized clayey soil treated with an alkaline solution of lignin in the amount of 0.5% dry lignin per weight of soil increased the amount of water stable aggregates (>0.25 mm) from 51.2% up to 82.6% (9).

Table 1

Structure forming ability of peat gum		
Soil	Quantity of peat gum in % per weight of soil	Quantity of water stable aggregates >0.25 mm, in %
Sod-podzolic clayey gley	0	38.2
" " "	0.5	68.2
" " "	1.0	82.0
Sod-podzolic loamy	0	64.9
" " "	0.5	71.1
" " "	1.0	77.1
Sod-gley clayey	0	58.8
" " "	0.25	77.1
" " "	0.50	84.0
" " "	1.0	87.6

Humic acid. Isolated from top peat according to Sven-Oden. Introduced into soil also in 1% KOH. On the same soil and in the same dose as lignin, it exerted similar action. The total number of water stable aggregates of the same sod-podzolic soil increased from 51.2% up to 81.6% (9).

Bitumens. Bitumens were extracted from peat (according to Stadnikov) with benzene alcohol within 8-10 hours with a subsequent distillation of the benzene alcohol. They were introduced into the soil in 1% KOH (8). On specimens of the same sod-podzolic soil, peat bitumens introduced in a dose similar to that of lignin and humic acid increased the total number of water stable aggregates from 51.2% up to 85.8%.

On the basis of a study made of the structure conditioning action of different fractions of organic substances, two technical products were suggested for the improvement of soil structure water stability, namely - peat gum and gum derived from plant re-

mains.

Peat gum. Partially dry semidecomposed peat of lowlands, uplands and transitional marshes is boiled in 1% KOH at a 1:10 ratio of dry peat to the solution for the duration of one to two hours (from the time it begins to boil). The liquid is cooled, allowed to settle and then poured (or it is drawn off through a ceramic filter) into a prepared container. This poured off, transparent, dark-brown liquid is called peat gum. The liquid (colloidal solution) isolated from upland peat contains 4-5% of organic substances of approximately the following composition: a water soluble fraction 17.2%, benzene alcohol soluble [fraction] 19% and a humate one 53.5%. The peat gum is introduced into the soil in liquid form. After wetting the soil to a specified depth, it is dried to an optimal moisture for structure formation. At this moisture it is aerated with cultivators and harrows or rakes depending on the sizes of the fields. The macro-aggregates created by means of treatment acquire the properties of water stability after drying. No difficulties are encountered in the drying of peat gum [Begin p.30] ("soft" drying at a temperature not exceeding 60° [C]) or in its introduction in dry form into moist soil (preferably in the spring). Laboratory and field experiments conducted on various soils (preponderantly on those of the podzolic type) have demonstrated that peat gum - in doses of 0.25; 0.5; 1.0% dry gum substance per weight of soil - increase the water stability of soil aggregates. A 1% quantity of gum introduced into heavy loam and clayey soils produces about 62-87% of water stable aggregates, which comes

close to ordinary virgin Chernozems of an analogous mechanical composition (table 1).

Field experiments conducted with various crops have also given positive results, as has been demonstrated by Koliasev (6), Vershinin (1) and a number of other authors.

Structure Conditioning Substances from Plant Waste
(Complex Lignohemicellulose Substances)

Gummy substances derived from Asiatic cotton and reed. Asiatic cotton [guza-pai - *Gossypium hirsutum* (?)] and reed were cooked in an autoclave at a pressure of 2 atm in a 1% alkaline solution for two hours, at a 1-10 ratio of dry organic substances and water. The liquid called respectively "gum from Asiatic cotton" and "gum from reed" were used as structure conditioners. Experiments were conducted on loamy gray soils. Better structure conditioning properties were displayed by "the gum from Asiatic cotton". In field experiments, the total number of water stable aggregates >0.25 mm rose from 1.0% up to 84.2%. They proved, however, biologically unstable and by December (the experiment was begun in July) the number of the same fractions decreased to 0.5% and 7.7% respectively.

Similar technology was used in the boiling of gummy substances derived from geranium waste (Institut Vlazhnykh Subtropikov v Sukhumi [Institute of Humid Subtropics in Sukhumi]). These gummy substances also exerted positive action upon the increase in water stability of soil structure. The quantity of water stable aggregates on the podzolic loamy soils of Sukhumi increased from

41.0 up to 76.0 when these substances were introduced into the soil.

Resin gum. Resin structure conditioning substances differ sharply from those described above as to the action they exert upon the physical properties of the soil, as well as to the quantity to be introduced into the soil. We used gummy substances of resin obtained from cheap varieties of resin soap or technical resin. Rosin, as is known, consists of a complexity of resin acids with a considerable preponderance of abietic acid ($C_{20}H_{30}O_2$). The abietic acid of rosin is insoluble in water, but potassium and sodium soaps are readily soluble in water. After saponification of rosin (according to the saponification number), we obtained a so-called resin gum. It can be introduced into the soil in the form of a water solution of the desired concentration, or in the form of a powder. When it was introduced in the amount of 0.05% per weight of the soil, then it increased the water stability of the total number of aggregates of sod-podzolic loamy soil >3 mm from 3.8% up to 49.7%. When a dose of 0.1% [was introduced] into the same soil, then the quantity of water stable aggregates reached 88.0%. Their [ability] to decrease the hydrophily of soil is a characteristic of these structure conditioning substances. Yet, numerous field experiments conducted on soils of the sod-podzolic zone indicate that the yield of a large variety of agricultural plants always increases (4, 5) when these substances are introduced in specific doses. In table 2 cited below are tabulated

the data of field experiments conducted for the purpose of establishing the doses of sodium abietate that increase barley yield. The experiments were conducted by Ia. A. Kovalev in the year 1938 on the sod-podzolic loamy soil of the training field belonging to the Leningrad Agricultural Institute. The size of the test plot is 40 m². Controls and experimental variants received N₇₅P₇₅K₇₅ [sic]. [Begin p.31].

Table 2

Influence of sodium abietate upon barley yield

Gum introduced in kg/ha	Average weight of four repli- cations in kg per test plot		Converted to ha		Increase in %	
	Grain	Straw	Grain	Straw	Grain	Straw
0	12.8	14.6	32.0	38.5	0	0
10	13.3	15.8	34.3	39.5	7.2	2.6
50	14.1	17.1	35.3	42.8	10.3	11.3
200	14.8	16.0	37.0	40.0	15.6	4.0
1000	14.8	19.1	37.0	47.8	15.6	24.2
2500	14.2	17.6	35.5	44.0	10.9	14.3

It follows from data in table 2 that a dose of resin gum [introduced] at the rate of 200 kg/ha is best.

On Reciprocal Action Between Structure Conditioners and the Soil

Let us cite some results without dwelling on the historical development of concepts about the reciprocal action occurring between structure conditioning substances and the soil. It has been held that there were two problems: 1. Reciprocal action between structure conditioners and the mineral particles of the soil, 2. The interaction of molecules within the structure conditioners themselves. The interaction occurring between structure conditioners

and the soil was interpreted as a surface phenomenon. Gummy structure forming substances must be adsorbed by soil fragments and must be held on their surface by inter-molecular (Van der Waals) forces. The mechanism of this phenomenon adds up to the following - there is a double layer of ions between the molecules of the structure forming substances and the surface of the mineral particles of the soil. The surface layer of ions (cations) hinders the manifestation of the cohesion forces between the molecules of the structure conditioners and the soil fragments, because it stands in their way and acts as a repellant force. The more hydrated the ions of the diffusion layer, the farther will they repel the molecules of the gummy structure conditioners from the surface of soil fragments. Yet, as the soil dries, the hydrate ion membrane is destroyed and the cohesion forces between the molecules of the gummy substances and the soil particles increase. Finally, there develops a state of affairs in which the Van der Waals attraction forces begin to surpass the repellant ion forces and the structure conditioners are adsorbed by the soil and are held by the inter-molecular bonds. The double layer ions act not only electrostatically; their chemical affinity with gummy substances as well as with mineral soil particles is of great importance.

As has been noted above, all structure conditioners must be readily soluble in water, must saturate the soil and must be adsorbed by its mineral particles. Hence there follow two principles:

a) the reactive surface is to be considered the specific soil sur-

face, b) structure conditioners are to produce the best effect on structure formation [when applied] in amounts equaling one molecular covering of the surface with a gummy substance. If it were considered that the surface of one gram of heavy loam soil is approximately equal to 10^5 cm^2 , and the thickness of a monomolecular layer for lignin equaled approximately 10^{-7} cm according to Wedekind and Katz measurements (Wedekind and Katz, 23), then the volume of the structure conditioner per gram of soil will equal $10^5 \text{ cm}^2 \times 10^{-7} \text{ cm} = 10^{-2} \text{ cm}^3$, or supposing the specific weight of humic acid and its related substances equalled 1.3, then we shall have $10^{-2} \text{ cm}^3 \times 1.3 = 0.013 \text{ gm}$ or 1.3% specific weight of the soil. The humic and related substances cited earlier actually produce [Begin p. 32] a good structure conditioning effect when introduced into the soil in amounts of about 1% of its weight. If, However, the structure conditioning effect of abietate gummy substances manifests itself in smaller amounts, then the thickness of the monomolecular layer is correspondingly lower.

The reciprocal action between the molecules of gummy structure conditioning substances is important in the sense of the conversion of these substances in the soil into an insoluble state. They form a membrane that connects the soil particles and protects them from the destructive action of water. The transition from a soluble into an insoluble state occurs in most cases as a reaction of polymerization with the assistance of either a hydrogen bond, or a bond at the expense of the basic valent forces.

As regards the character of their transition into an insoluble state, all structure conditioning substances listed can be broken down into two types: 1. substances that convert into an insoluble state only when there are exchange reactions with the soil, 2. substances that convert into an insoluble state regardless as to whether there are exchange reactions with the soil or not.

The first type includes humates and related compounds as well as all substances introduced into the soil in the form of soluble soaps, for example:



As a result of an exchange with the soil absorption complex, potassium humate converts into a humic acid which, as has been demonstrated by our investigations (3), turns into a jelly that, with the loss of a certain amount of water, grows insoluble in water. Similar reactions occur with potassium and sodium abietates. It can readily be seen that in this case it is important that exchange soil ions and molecules of gummy substances form insoluble compounds.

The second type includes viscose which, under the influence of air carbon dioxide, converts into an insoluble cellulose independently of exchange reactions with the soil.

Krillium. In recent years interest in a [soil] structure conditioner was noted in the foreign press, particularly in the American (without making any mention of our work). Attention was

called to various structure conditioners¹. Among those proposed were the salts of polyuronic acids and derivatives of polysaccharides, derivatives of cellulose (methyl cellulose), sodium silicate, organic silicate compounds (dimethyl dichlorosilane), and the stearic, alginic and abietic acids. In american post-war literature began to appear numerous suggestions for synthetic structure stabilization that repeated our investigations of 1932-1936.

Structure conditioners of a somewhat different type suggested in the year 1951 aroused the interest of large firms. After many years of investigations conducted in the laboratory and on field test plots, the firm Monsanto Chem. Co. suggested the derivatives of polyacrylic acids as [soil] structure conditioners. They were given the collective name of "Krillium". Two brands of structure conditioners were suggested: CRD = 186 (copolymers of vinyl acetate and maleic acid) and CRD = 189 (hydrolyzed polyacrylonitrile). In the year 1952, different firms suggested structure conditioners named: "Polyac", "Fluffium", "Aerotil", "Loxar [Loksar]". Information about Krilliums got into the European press and a number of European States (Belgium, France, Federal Republic of Germany [FRG], German Democratic Republic, Hungarian People's Republic, Italy, England and others) proceeded to study the American Krilliums

¹ See Journals: Soil Sci. America Proc., v. 10, p.450, 1945; J. Amer. Soc. Agron., v. 38, p.95, 1946; J. Agric. Sci., v. 37, p.257, 1947 and others.

and to release their own. [Begin p.33]. As of now, the American Krilliums of the Monsanto firm indicated above enjoy the greatest distribution; they are now frequently and appropriately called by the names of VAMA (vinyl acetate maleic acid) and HPAN (hydrolyzed polyacrylonitrile).

Detailed information on these substances was obtained from the first publications of the following authors: Hedrick a. Mowry [Khedrik and Mourl] (18), Allison [Ellison] (13), Martin and Taylor [Martin, Teilor] (20), Ruchrwein and Ward [Rechrvein and Uord] (22). It follows from the data of these authors that Krilliums fully stabilize soil structure when introduced in amount of 0.1% per weight of soil, but even amounts of 0.05 and 0.02% produce good results on some soils. The effect of structure stabilizing not only does not deteriorate on solonets soils, but even increases. The introduction of Krilliums does not impair the hydrophilic capacity of the soil. The yield of many agricultural crops increases from the use of Krilliums. They are not badly decomposed by microorganisms and the water stability of soil structure created by Krilliums lasts for a number of years.

Krilliums are typical polymers that in most cases are already used in industry for various purposes (plastic materials, lacquer, organic glass etc.). The basic link of Krilliums is the initial monomer. For acrylic acid it is $\text{CH}_2 = \text{CH} - \text{COOH}$ with a molecular weight of 72.06; for metacrylic [acid] $\text{CH}_2 = \text{C} - \text{CH}_3 - \text{COOH}$ with a molecular weight of 86.09; for maleic [acid] $\text{COOH} - \text{CH} = \text{CH} - \text{COOH}$ with a molecular weight of 116.07.

In the process of polymerization that usually occurs under the influence of catalysts, the individual links (monomers) begin to combine and form long chains. The number showing how many times a given link reappears in the chain is called the polymerization coefficient. Polymeric chains of varied chemical structure can unite with each other thus forming a copolymer. A polymer of acrylic acid is called polyacrylic acid, a polymer of metacrylic acid - polymetacrylic acid etc. Each link contains either one active group or another: carboxylic, amide, nitrile and others. If the carboxylic group in acrylic acid were replaced by the amide one then the [acid would be called] polyacryloamide [acid], if replaced by the nitrile one then - polyacrylonitrile, and so forth. A polymerization reaction is usually associated with the unbinding of double bonds, on the strength of which molecules become activated and require the ability to react to each other. In copolymers the number of active groups per unit weight of substance is higher than in polymers.

What new contribution has the use of polymers made to the theory of synthetic structure formation. As has been pointed out above, the creation of water stable [soil] structure requires considerably smaller quantities of these substances than in the case of humic substances (approximately 10 times [less]). We have obtained such quantities of gummy substances that bring about complete structure stability [ostrukturivanie] from resin gums. But unlike these, Krilliums do not reduce the hydrophilic capacity

of soil. The water stability brought about by these substances depends very little on the absorption complex. As has been demonstrated by Allison (14), soils saturated with sodium even increase the structure stabilization effect of VAMA and HPAN Krilliums. Reaction between polymers and the soil occurs on the surface of the soil particles.

When the same quantity of polymers is introduced into the soil, the structure stabilizing effect drops, if the quantity of clayey particles is increased in it; this was demonstrated in mixtures of sand and clayey minerals (kaolinite [kaolinit] and montmorillonite in the form of bentonite) by Hagin and Bodman [Khegin and Bodmen] (17) and confirmed by Allison in a series of soils. Hagin and Bodman associate the given phenomenon with the size of the specific soil surface as shown in fig. 1 taken from the work of these authors. In the opinion of Ruchrwein and Ward (22), the structure stabilizing mechanism provoked by polymers [Begin p.34] is of a coagulative character: the polymers are typical polyanions or polycations. Since they are distributed among soil fragments they coagulate them.

Fig. 1. Minimum quantity of SRD-186 necessary for a complete aggregation in relation to the calculated specific surface (17)

[Legend of fig. 1]: Specific surface, M^2

Montgomery and Hibbard [Montgomeri and Khibbard] (17) made an interesting attempt to connect the physico-chemical properties

of Krilliums that are highly molecular polymers with soil conditions. They arrived at the conclusion that the activity of polymers (i.e. their structure stabilizing properties) depends on their "functional capacity" under soil conditions (the term "functional capacity" implies the relation of the number of active groups in the repetitive chains to the total weight of the polymer chains). Polymer activity under soil conditions increases with the growth of "functionalism", reaches a maximum, and then drops despite the growth of "functionalism"; if "the functional capacity" is low then the number of active groups is insufficient to achieve binding with soil particles, if, however, "the functional capacity" is high then the activity of the groups is very great, which influences the solubility of a polymer in water.

As the molecular weight of a polymer increases, its activity under soil conditions rapidly reaches a maximum and then drops, which is connected with the viscosity of the polymer and its capacity to be adsorbed by soil particles. In experiments conducted with sulfonated polystyrene the relation of polymer activity under soil conditions to the number of sulfonate transverse seams was established in molecule chains. The [polymer] activity decreased as the number of seams increased.

The approximate relationship between the binding forces of the sulfo groups, the carboxylic and the amide groups is expressed as 1.6 : 1.0 : 0.8 respectively. A hydrogen bond [sviaz'] obviously arises between polymers and soil particles.

Emerson (15), in using as a basis the measurements of French and others (16) who demonstrated by the method of infrared spectroscopy that hydrogen bonds increase when an additive of CRD = 186 is injected into montmorillonite, believes that there arise hydrogen bonds (vertical and lateral little bridges) between polymers and clayey minerals. Emerson considers that the action of polymers is more effective in the case of the lateral little bridges. On the basis of infrared radiation spectra taken on kaolinite, montmorillonite and illite treated with polymer S-17 (polyamide-semiammonium salts of the copolymer of methyl vinyl ester and maleic acid), Holmes and Toth [Kholms and Tos] (19) have also pointed out the emergence of hydrogen bonds between clayey particles and the polymer.

We have tested a series of Krilliums prepared in the USSR. Tests made of polyacrylonitrile on sod-podzolic loamy soil produced the following results: when polyacrylonitrile was introduced in the amount of 0.1% per weight of soil, then water stable aggregates larger than 0.25 mm comprised 95-96%, yet in control soil they made up only 26.5%. The aggregates obtained with the aid of polyacrylonitrile were ground to a powder and [when] newly aggregated under moist [soil] structure conditioning, they restored their water stability. In this case the water stable aggregates comprised 93.5%. Thus, polyacrylonitrile restores the properties of water stability when lumps [of soil] originate after a mechanical destruction of aggregates. It is known from

chemistry that many polymers possess the properties needed to restore polymer chains after a mechanical destruction.

Polyacrylonitrile is adsorbed by the soil. One hundred gm of the same soil and a five replicate amount of polyacrylonitrile solutions of various concentrations were taken for the experiment. [Begin p.35]. Fig. 2 shows the character of polyacrylonitrile absorption by sod-podzolic loamy soil. It can be seen from fig. 2 that polyacrylonitrile absorption by soil is a linear function of concentration.

Experiments conducted in synthetic structure conditioning in past years convinced us that the relatively large quantities of structure conditioners of the humate type required for structure stabilization are the fundamental deterrent against their utilization in practice. Hence we, in our experiments with Kriliams, were especially interested in the problem of reducing the quantity needed for the stabilization of soil structure. In conjunction with the Institute of High-Molecular Compounds, Academy of Sciences USSR*, we conducted several elementary experiments. The monomer of metacrylic acid is soluble in water. The conversion of a monomer into a polymer requires specific conditions and, in particular, the introduction of a catalyst into the monomer. A polymer of

* Institut Vysokomolekuliarnykh Soedinenii AN SSSR [Institute of High-Molecular Compounds, Academy of Sciences USSR].

metacrylic acid (polymetacrylic acid) is insoluble in water. In our experiments the quantity of water stable aggregates in sod-podzolic loamy soil increased from 22% up to 75% when a monomer of metacrylic acid in the amount of 0.1% per weight of soil was introduced in it. Consequently, sod-podzolic loamy soil is itself a catalyst and converts monomeric metacrylic acid were strengthened by its copolymerization with metacrylamide. Data on the influence of one of these copolymers (N VIII) composed of metacrylic acid (60%) and metacrylamide (40%) for the water stability of the same sod-podzolic loamy soil are cited in table 3.

It follows from data in table 3 that even a copolymer introduced into the soil in the amount of 0.001% per weight of the soil increases essentially the water stability of soil structure. Inasmuch as the quantities of the gummy substances introduced are so small, one can draw the conclusion that the theory of a monomolecular covering of the surface of particles cannot serve as an explanation of the resultant water stability. Obviously, the mechanism of gluing together [soil] particles by means of polymers is different from the one indicated earlier for substances of the humate type. Evidently, the hypotheses concerning the emergence of chemical bonds between a polymer and clayey particles have a basis of their own.

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Fig. 2. Absorption by sod-podzolic loamy soil of polyacrylonitrile from solutions. Ratio of soil and solution 1 : 5

1 - Basic experiment; 2 - Replication
 [Legend of fig. 2]: Concentration of polyacrylonitrile, %
 [Vertical line]: Absorbed in grams per 100 gm of soil

Table 3

Influence of a copolymer of metacrylic acid and metacrylamide upon the water stability of sod-podzolic loamy soil structure	
Quantity of the introduced copolymer in % per weight of soil	Quantity of water stable aggregates >0.25 mm in % per weight of soil
0.1	92.0
0.05	90.2
0.01	86.0
0.005	56.8
0.001	51.8
0	18.4

Let us make a simple computation. We shall assume that a link of a copolymer has the molecular weight of about 200; then one gram of this copolymer will contain the [following] monomer links:

$$\frac{6.06 \cdot 10^{23}}{200} = 3.03 \cdot 10^{21}$$

[Begin p.36]. If the polymerization coefficient were considered approximately equal to 15,000 (which is close to the magnitude given by Emerson in the case of Krilliums), then the number of chains per gram would be

$$\frac{3.03 \cdot 10^{21}}{1.510^4} = 2 \cdot 10^{17}$$

Our minimal dose = 0.001% (or 10^{-5}) contains the [following] chains $2 \cdot 10^{17} \times 10^{-5} = 2 \cdot 10^{12}$. According to a mechanical analysis, an approximate count of the number of particles per gram of the indicated soil gives a magnitude that comes close to approximately 10^{12} . Approximately one polymer chain is required when soil is rendered cohesive by means of a polymer at the rate of 0.001% per particle of soil. It would seem that in such a case complete stabilization of soil structure would have to be observed. This, however, is not true.

Consequently, not only the specific soil surface plays a role in the reciprocal action occurring between a polymer and the soil, as has been deemed by Hagin, Bodman and Allison, but soil porosity as well. The finer the pores of the soil, the "more difficult" is it for long polymer chains to penetrate them: the soil lets them through like a sieve. Hence it is important to develop methods for the introduction of polymers into the soil.

In saturating the soil, the polymer fails to produce a completely uniform distribution of the chains among soil particles. Therefore, mixing and repeated saturation should increase the effectiveness of polymers. This can be seen from data cited in table 4.

It follows from data in table 4 that repeated saturation of the soil with a copolymer in the amount of 0.001% per weight of the soil increased considerably water stability of soil structure (compare table 3). Calculations show that the total amount of a

polymer applied in the given case to a hectare at a 20 cm depth of the arable layer and a volumetric weight of the soil equaling 1 amounts to a total of 40 kg. There is no doubt whatever, that these methods for soil structure improvement have a great future.

Table 4

Influence of the number of times saturated upon the water stability of aggregates of sod-podzolic loamy soil

Name of copolymers	Number of times saturated with the same concentration	Quantity of polymer introduced into soil in % per weight of the soil	Quantity of water stable aggregates >0.25 mm in %
Copolymer (VIII) metacrylic acid and metacryl-amide	1	0.001	51.8
	2	0.002	80.6
	3	0.003	81.4
	4	0.004	87.4

Conclusions

A series of organic compounds that improve soil structure were suggested at the Agrophysical Institute 26 years ago. But the amount of these substances needed to obtain high indicators of structure formation was large and, therefore, served as the main obstacle to their utilization in practice. In the postwar years new structure stabilizing substances of a high molecular type of polymers comprised chiefly of derivatives of acrylic, metacrylic and maleic acids were developed in the USA. The amounts of these substances required for soil structure stabilization are 10-20 times smaller than those of humates and related substances.

A study of the nature of the reciprocal action occurring between polymers and soil particles, and the method of their introduction into the soil will permit developing substances that will completely stabilize soil structure at the rate of a few tens of kilograms per hectare.

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Vegetatsionnyi period kukuruzy v
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[Vegetation period of maize on non-
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(In Russian)

High-stalked southern varieties and hybrids of corn, regionalized in the non-chernozem zone, can produce 700-800 and more centners of green mass from 1 ha [2.471 acres], but during most of the years they do not ripen, and at the time of harvesting the ears do not always attain the milk-wax stage of ripeness.

A question about unripeness of corn, which is of great production importance, has been studied for many years at the Scientific-Research Institute of Agriculture of Central Regions of the Non-Chernozem Zone.

Unripeness of southern varieties and hybrids of corn in the non-chernozem zone is being often attempted to explain by the shortness of the period of possible vegetation. Yet, near Moscow, the mean duration of the frostless period equals 130 days, and the period with a mean daily temperature above 10° to 135-140 days.

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Under conditions of the south this time is quite sufficient for the ripening of corn ears. Thus, the Sterling variety ripens fully in Kuban in 115-120 days, and variety Minnesota 13 extra - in 110-112 days after the appearance of sprouts. But in the non-chernozem zone the southern varieties have no time to ripen and are harvested, as a rule, before the coming of the milk-wax stage. This occurs not on account of the shortness of the period of the possible vegetation of corn, but because of the retarded pace of its development.

What are then the causes of the setback in the development of corn in the non-chernozem zone and what are the means for overcoming its effect?

Many factors influence the development of corn plants; first of all, light, heat, moisture and elements of mineral nutrition.

All these factors jointly affect the development of the corn plant. Nevertheless, their role is unequal, and, therefore, the influence of each of these factors was studied separately.

Light. It is customary to think, that the length of the summer day, which increases in the direction from south to north, influences negatively the course of development of corn in northern latitudes. Such an opinion is based on results of photoperiodic experiments, in which corn tasseled and ripened earlier than under natural conditions, when grown under conditions^{of} an artificial shortening of the day to 8-10 hours. Yet it does not follow from this, that lengthening of the light day must retard corn develop-

ment. Such a regularity was not observed in reality (table 1).

It is seen from table 1 that, under conditions of lands near Moscow, corn developed, practically, in the same manner while growing in natural daylight or when it was continuously subjected to light, during days and nights. When analyzing data of Government variety test plots, that were situated on the same longitude, the picture became still more convincing. Thus, for instance, in 1954, at the Gzhatsk GSU [Government variety test plot] (55° 35' north latitude) plants of corn of sterling variety tasseled in 61 days after the appearance of sprouts, and at the Barvenkov GSU (48° 54' north latitude) in 74 days; in 1955, respectively in 77 and 85 days. Those years, in the region of the Gzhatsk GSU, during the first period of development of plants, [Begin p.24] the weather was warmer than in the region of Barvenkov GSU. Thus, here heat was the deciding influence and not the length of the day.

table 1

Length of the period "appearance of sprouts - tasseling" of corn, depending on the length of the day

Varieties and hybrids	Natural day			Continuous illumination		
	1956	1957	mean	1956	1957	mean
Leaming	73	98	86	79	92	86
VIR 42	61	76	69	63	75	69
Voronezhskaia 80	42	64	53	44	65	55
Nemchinovskaia	46	63	55	44	65	55
Slavgorodskaia 270	37	58	48	37	61	49
Sibiriachka (Minusinka)	26	63	45	28	64	46

Footnote. At night the plants were illuminated with 300-watt lamps.

One should mention that the shortened (10 hour) day cannot be regarded as the best for corn, since during such days the speeding up of the development of plants is a reaction of corn to unfavorable conditions. A 10-hour day requirement could not have been developed by corn since this crop, in its process of historical development, was never grown under conditions of such a day. Corn plants, grown under conditions of an artificially shortened day differ from plants, grown in natural day-light, by a smaller height, smaller size of tassels and ears, and, what is especially important, by a smaller amount of leaves (2-3 leaves)*. Reduction in the amount of leaves is then the chief cause of the shortening of the period from sprouts to tasseling, and, in connection with this, of the vegetation period of corn as a whole.

One does not observe any deviations from the norm in the growth when corn is grown under conditions of a long day or even of continuous day and night lighting. Apparently, one can, rather, speak about the positive effect of a lengthened day, since in this case the time of work of the leaves is lengthened; as result of this the plants develop a more vigorous overground mass. Thus, the five-year study of the effect of the length of day on the development of corn in the non-chernozem region has shown, that the increased length of day is not a negative factor for corn.

Heat. Quite different results were obtained in studying reduced temperatures on the development of corn in the non-chernozem zone. The temperature proved to be a deciding factor in the develop-

* Such a reduction in the number of leaves is observed also when the young plants, during the period of formation of leaves, are subjected to a deficiency of moisture or of elements of mineral nutrition.

ment of the corn plant during the course of the entire period of its life, beginning with seed germination and up to the time of ripening. The biological essence of temperature influence consists in the fact that the reactions of synthesis of the organic substance are endothermic reactions, the speed of which, and consequently, the rates of growth and development of plants, depend on the amount of heat.

As the experiments have shown, the most rapid growth and development of corn was observed at the daily mean temperature of 23-25°. Length of the inter-phase periods increased and the vegetation period lengthened with the reduction of temperature. Thus, at a temperature of 20-22°, the corn sprouts appeared in 6 days after planting, and at the temperature of 11-12° only in 15-17 days. With a further drop in temperature, the appearance of sprouts [Begin p.25] can be delayed for 25-30 days. Appearance of the 10th leaf, at a temperature of 18-19°, occurred in 26 days after sprouting, and in 53 days at a temperature of 14-15°. The tasseling phase in corn, of the variety Minnesota 13 extra, occurred at a mean daily temperature of 18-19° in 58 days, while at 15-16° only in 90 days after the appearance of sprouts. Length of the periods between the remaining phases of development (tasseling-flowering, flowering - milk stage, and so on) is in similar dependence on the temperature.

In the non-chernozem zone there are few days with the best temperature for the development of corn (23-25°). In the lands

around Moscow, for instance, the mean daily temperature in July does not exceed 18° ; in connection with this the vegetation period of southern high-stalked varieties is extended here, and to the moment of harvesting, as a rule, they fail to attain the milk-wax stage. Only during the years with an especially hot summer (1954) corn developed in the non-chernozem zone at almost the same rate as in the south, regardless of the longer day.

Moisture. Effect on growth and development of corn of the remaining factors, necessary for life, depends on temperature conditions. With one and the same amount of rainfall in the southern regions of the country the corn plants can experience a sharp deficiency in moisture, and in the non-chernozem zone they will be under conditions of sufficient moisture since, on account of reduced temperatures, the evaporation here proceeds less intensively than in the south. But besides the effect of the temperature level on the moisture content of the soil, there takes place also the reversed effect of the degree of moisture on the temperature of the soil: with an increase of moisture, the expenditure of heat for evaporation increases; as a result of this the moist soil warms up much slower. Difference in temperature of the moist and of slightly moist soil sometimes attains $4-5^{\circ}$, and this produces a substantial effect on the activity of roots and the general development of the corn plant.

Elements of mineral nutriment. At a reduced temperature of the soil (13°) the root system of corn assimilates nutrient substances

2-3 times slower than at a higher (20°). Nevertheless, it was ascertained, by experiments, that by means of additional introduction of fertilizers into the cold soil, it is possible to intensify the absorbing activity of the roots and increase the inflow of nutrients into the plant. Corn usually was much more vigorous, with a dark green coloring of leaves during the years with a cool summer on sections of the field where, for a long time, heaps of unscattered manure were lying; it usually tasseled and ripened much earlier than on the rest of the field. Consequently, on the general background of reduced temperature, corn can grow and develop differently, depending to what measure it is provided with elements of mineral food. Increase of soil fertility in the non-chernozem zone can, to a considerable degree, reduce the negative effect of heat deficiency.

Thus, among all the factors, required for the normal growth and development of corn in the non-chernozem zone, heat exists in the smallest amount. In order that under these conditions corn would have time fully to complete its cycle of development, it is necessary to adapt it to the temperature regime present in the non-chernozem zone.

It is characteristic for the central part of the Moscow oblast', for instance, that with a sufficiently long total duration of a period with temperatures above 10°, the mean temperature of the hottest months does not go beyond 18°. There are only 70 days a year with a mean temperature above 15°. The sum of positive tem-

peratures comprises 1,900-2,100°, which answers the requirements of only the borderline early-ripening corn varieties. The sum of effective temperatures (over 15°) equals 628°. [Begin p.26] The highest temperature is observed in the 20th days of July. The period of possible vegetation and the sum of temperatures is divided by this date in two uneven parts: larger and smaller.

The whole period of life of the corn plant can be divided into the following parts: planting - sprouting, sprouting - tasseling, tasseling - flowering, flowering - ripening. The length of the first period can change, depending on the soil temperature, but, with the best time of planting, it is practically similar for all varieties.

The period from sprouting to tasseling lasts for some varieties 40-45 days, and for others 85-90, and even more, days. As to the periods from tasseling to flowering and flowering to ripening, their length shows nonessential variations for different varieties, if they run under similar temperature conditions*. This can be seen from results of the experiment, in 1957, when the seedlings of the medium late variety Partizanka were grown in peat-compost pots; as the result of this the appearance of styles on ears of this variety and of that of the early-ripening variety, Slavgorodskaja 270, almost coincided in time; for the Partizanka variety it occurred on August 11, and for Slavgorodskaja 270

*At the first sight it seems that in late varieties these periods are considerably longer than in early-ripening, because they bloom at a different time and the formation of grains in late varieties proceeds under conditions of lower fall temperatures.

variety on August 13; the length of the period from the appearance of styles to the milk stage comprised respectively 30 and 27 days.

Thus the study of the structure of the vegetation period of different varieties of corn has shown that the period of sprouting - tasseling showed the greatest variations in duration. This part of the vegetation period is the longest: in early-ripening varieties it comprises almost half, and in late varieties even more than half of the entire period of vegetation; and it is exactly it that determines the length of the total vegetation period under conditions of the non-chernozem zone. In order to become convinced of this, it is necessary to consider the progress of development of corn on the example of several varieties.

In the lands around Moscow corn sprouts usually appear at the end of May or at the beginning of June. In early-ripening varieties (Sibiriachka, Slavgorodskaya 270 and others) tasseling occurs 40-45 days after the appearance of sprouts; that is, in the middle of July. Almost the same amount of warm days and almost half of the total sum of effective temperature remain for further vegetation. This proves to be sufficient for the forming of the grain and its attainment of the wax stage or even full ripeness.

A different picture is observed in growing such late varieties as Leaming or Odesskaya 10, in which the period from sprouts to tasseling continues 85-90 days. In this case the flowering occurs at the end of August, when very few days remain before the early frosts and there is neither time nor heat for the formation of

grains. Even the not so late varieties, whose period from sprouting to tasseling continues 55-60 days, are found under conditions that are unfavorable for ripening. The matter is that after July the daily mean temperatures fall sharply, and even insignificant shifting of the phase of blooming, from July to the second half of the summer, leads to a sharp reduction of the sum of effective temperatures that remain for the formation and ripening of grains. In the sum of effective temperatures, which exceed 10° , one July day is equivalent to 8-10 September days. That is why it is so important for the ripening of corn [Begin p.27] that the flowering occur as near as possible to the middle of July. Thus, the reduction of the length of the period of sprouts - tasseling is the chief reserve, at the expense of which the reduction of the vegetation period of corn and the ensuring of the possibility of its ripening, under conditions of the non-chernozem zone, is possible. But the period from sprouts to tasseling is not uniform; it, in its turn, is comprised of individual parts, the number of which corresponds to the number of leaves in the given variety.

Corn, practically, has no varietal differences in the number of embryonic leaves: all varieties have 5 or 6 of them. Differences appear only at the time of tasseling, when in early-ripening varieties there are only 9-10 leaves, and in the late-20 to 22 and even more. During the process of development the formation of sequential leaves continues after the appearance of sprouts; each of the

leaves appears after a definite period of time and in the presence of a definite sum of effective temperature. The tassel appears after one last leaf. As the number of leaves is a very stable varietal symbol, and a definite time is required for the formation of each leaf, it is natural that varieties of corn with a smaller amount of leaves tassel, flower and ripen earlier than varieties with a larger amount of leaves. It was necessary to find out if there are varietal differences in the rate of appearance of sequential leaves in order to ascertain, how full is the dependence between the number of leaves and the length of the vegetation period of corn. The Institute of Agriculture of Central Regions of the Non-Chernozem Zone studied for this purpose, during the course of 1957-1958 a great collection of the open-pollinated [svobodnoopyllia]ushchikhsia] varieties of interlinear hybrids and of self-pollinated lines of corn (table 2).

Table 2Rate of appearance of leaves in open-pollinated varieties
of corn

Varieties	Mean number of leaves	Number of days from the appearance of sprouts to the emergence of the				
		3rd leaf	6th leaf	9th leaf	12th leaf	15th leaf
Sibirskachka (Minusinka)	10-11	4	24	35	-	-
Slavgorodskaya 270	11-12	4	24	37	47	-
Urozhainaya	11-12	3	23	38	45	-
Chakinskaya zhemchuzhina	12-13	3	23	37	44	-
Bezenchukskaya 41	13-14	4	26	38	47	-
Nemchinovskaya	13-14	4	24	36	46	-
Voronezhskaya 80	13-14	3	27	39	48	-
Voronezhskaya 76	13-14	4	25	38	48	-
Khar'kovskaya white dent corn	14-15	4	24	37	47	61
Grushevskaya	16-17	4	24	37	48	59
Minnesota 13 extra	16-17	4	24	37	46	55
Partizanka	16-17	4	25	38	46	57
Sterling	17-18	4	23	36	46	60
VR 42	16-17	4	25	37	48	57
Leskaya 10	20-21	5	25	38	49	61
Leaming	21-22	5	25	38	49	61

There were practically no varietal differences in the time of appearance of sequential leaves (table 2). Consequently, the length of the period from the appearance of sprouts to the emergence of the tassel in open-pollinated varieties is in direct dependence only on the number of leaves. Somewhat different [Begin p.28] results were obtained by the author and by Z. F. Baliura when studying the time of emergence of leaves in interlinear hybrids and in self-pollinated lines (table 3)

Table 3

Rate of appearance of leaves in interlinear hybrids and in self-pollinated lines of corn

Hybrids and their parental forms	Mean number of leaves	Number of days from the appearance of sprouts to the emergence of the				Mean number of days needed for the formation of a leaf
		3rd leaf	6th leaf	9th leaf	12th leaf	
Line VIR 26	14.5	7	34	44	54	4.3
Iskra (26X27)	16.0	6	29	43	53	3.9
Line VIR 27	15.5	7	36	47	56	4.3
Line VIR 28	14.5	9	41	53	64	4.8
Ideal (28X29)	16.5	7	32	45	53	4.1
Line VIR 29	15.5	6	33	46	56	4.4
Line VIR 44	15.0	8	34	45	56	4.2
Slava (44X38)	17.5	6	34	41	51	3.6
Line VIR 38	15.0	8	39	49	60	4.7
Line VIR 40	15.0	9	37	50	61	4.7
Svetoch (40X43)	17.5	7	35	46	56	3.9
Line VIR 43	15.0	7	37	49	60	4.7

As a rule, plants of self-pollinated lines have somewhat fewer leaves than interlinear hybrids, but the emergence of each of them occurs after a longer interval of time; in connection with this, plants of self-pollinated lines enter the stage of flowering and ripening later. The slow rates of development of self-pollinated lines are, apparently, the result of self-pollination; acceleration in the development of interlinear hybrids is the results of the appearance of heterosis. The cited deviation from the rules is of great importance in the selection of self-pollinated lines under conditions of non-chernozem zone, and it must be taken into consideration when evaluating lines as parental forms of interlinear hybrids. Such deviations are very rarely observed in the open-pollinated varieties.

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The time, required for the appearance of the next leaf depends, to a large extent, on temperature conditions. The next leaf can appear, during hot weather, in 2-3 days after the preceding one, but during cold weather only in 10-12 days. Comparison of varieties for the rate of the emergence of leaves must be conducted on plants planted at one and the same time in a field similar in fertility. In order to determine the mean amount of effective temperature and time, required for the formation of one leaf, it is better to use data of experiments with dates of planting that will permit to observe development of corn under the most diverse temperature conditions (table 4).

It is seen from table 4 that the early-ripening, medium-ripening and late varieties form sequential leaves almost synchronously. In any case, difference in the number of days between the appearance of two sequential leaves in any pair of varieties, which are compared, proves to be greater than the triple error of the arithmetic mean. This indicates, that there is no proved difference among the varieties. [Begin p.29]

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Table 4

Rate of formation of leaves in different varieties of corn according to average data from experiments with dates of planting

Ordinal number of sequential leaves	1957			1958	
	Nemchino-vskaia	Odesskaia 10	Sibiriachka	Nemchino-vskaia	Odesskaia 10
2	1.5	1.6	1.5	1.2	1.1
3	2.5	2.7	2.7	2.6	3.0
4	5.6	4.8	4.8	4.8	5.5
5	6.1	7.0	6.3	6.6	6.2
6	4.3	4.7	5.9	5.8	4.9
7	4.1	4.4	4.2	3.8	3.8
8	3.8	3.9	3.3	4.4	3.2
9	4.3	4.0	5.0	3.1	4.6
10	3.6	4.1	4.8	4.8	5.2
11	3.8	4.0	-	3.2	5.2
12	4.5	4.3	-	5.6	2.9
13	3.6	3.4	-	4.1	3.8
14	-	4.2	-	5.4	5.1
15	-	4.3	-	-	5.4
16	-	4.8	-	-	4.6
17	-	4.6	-	-	4.7
18	-	5.2	-	-	6.9
19	-	4.3	-	-	8.0
Length of the formation of the 1st leaf	4.0	4.2	4.3	4.3	4.6
Mean sum of effective temperature for 1 leaf	27.6	28.2	29.3	26.0	27.9

Four to 5 days, with a sum of effective temperatures of 26-29°, are required on the average, for the formation of one sequential leaf. One can use these data in the non-chernozem zone for determining the time of tasseling in plants of one or another variety, proceeding from the number of leaves characteristic to it. But one should take into consideration that the period between the appearance of the last leaf and of the tassel is, approximately, the same in length as the time between the sequential leaves.

Varieties with 10 leaves bloom in the lands around Moscow, approximately, in the middle of July, with 11 leaves 4-5 days later; with 12 leaves, 8-10 days later, and so on. Varieties with 13-14 leaves bloom at the beginning of August and by the time of harvesting they succeed in forming ears of a milk-wax and even wax stage. Varieties, which have 15 or more leaves, do not produce stable yields of ears.

How is it possible to adopt corn to the temperature regime of the non-chernozem zone and secure the obtaining of stable yields of ears of milk-wax stage? This problem is reduced to the shortening of the period between the appearance of sprouts and the tasseling. This can be attained either by means of cultivating varieties or hybrids with a limited number of leaves, or by changing the nature of corn so as to reduce its heat requirements. The first method has been used long ago in the selection practice in moving corn from south to north. The forced and, sometimes, unconscious use of this course is connected to the fact that for each geographical region the number of leaves in corn [Begin p.30] is limited by a certain point beyond which its seed reproduction becomes impossible. For instance, in Krasnodar krai varieties and hybrids can ripen with 20-22 leaves; at the Khar'kov latitude - with 15-16, in the Voronezh region - with 13-14, but in Siberia with only 9-11 leaves. In mountainous regions with a vertical zonality the number of leaves in corn decreases as the locality rises above the sea level.

At the present time, almost all the scientific establishments of the non-chernozem zone, which are occupied with the selection of corn, follow the course of cultivating varieties and hybrids with a limited number of leaves. The selection work in these institutions is conducted in three basic directions: cultivation of new varieties, selection of parental pairs and production of intervarietal hybrids, cultivation of self-pollinated lines for obtaining interlinear hybrids. As a result of work in the first direction from different initial material and by various methods, new corn varieties were cultivated and are tested: Moskovskaia 3, Moskovskaia 5, Kazanskaia 108, Gorki Leninski 1. IGAN 1, [Geographical Institute of the Academy of Sciences of the USSR] IGAN 2, IGAN 3, IGAN 4, Podmoskovnaia, Nemchinovskaia and others. In spite of the fact that some of these varieties were cultivated by a method of selection and others by a method of hybridization, both at a controlled and an open pollination, they all have a common characteristic - similar number of leaves on a plant (13-14). Coincidence in the results of work of different selectioners attests about the matter that in the non-chernozem zone 13-14 leaves are that limit, beyond which obtaining ripe seeds of corn becomes ever more difficult and, finally, impossible.

Corn varieties, which were cultivated in the non-chernozem zone, have several positive characteristics, the most important of which is that by the time of harvest these varieties, as a rule,

succeed in forming the ears and attain the milk-wax stage of ripeness. Although they are inferior to the southern high-stalked varieties in the yield of green mass, but in the yield of feed units from one hectare of planting they prove to be equivalent, and, in some cases, they even surpass them.

It was established, as an outcome of work on the production of intervarietal hybrids, that the best results are obtained from crossing the early-ripening Siberian varieties with the high-stalked southern varieties (of the type of Partizanka and Minnesota 13 extra). The Siberian varieties proper are not of interest in a production respect since they are undersized and the ears are attached to the stalk very low. Yet, the early-ripeness inherent to them permits utilizing them successfully in hybridization as the mother forms, which are able to produce ripe seeds. Intervarietal hybrids, cultivated as a result of such crossings give in to the high-stalked varieties in the yield of green mass, but excel them in the yield of feed units. The best among these hybrids are Slavgorodskaya 270 X Partizanka. Sibiriachka (Minusinka) X Partizanka, Sibiriachka (Minusinka) X Minnesota 13 extra excel Partizanka in the yield of feed units from one hectare by 10-15% and are able to attain the phase of milk-wax ripeness. The drawback in these hybrids is in the fact that their parental forms differ sharply in the length of the vegetation period and, thus, require the growing of seedlings of the paternal (southern) variety in peat-humus pots; this serves as an obstacle for a wide

introduction of new intervarietal hybrids into production.

Cultivation of self-pollinated lines in the non-chernozem zone is hampered by the fact that the rate of their development (in consequence of depression from self-pollination) becomes still more slowed down than in the initial varieties. Therefore [Begin p.31] only lines with 10-12 leaves are suitable here for seed reproduction, while the open-pollinated varieties can have 13-14 leaves.

The simple interlinear hybrids, which are obtained from crossing such lines, can be utilized as mother forms for the production of better yielding double interlinear hybrids, which have 13-14 leaves*. Nevertheless, with the number of leaves is connected not only the length of the vegetation period, but also the yield of green mass; therefore, the early-ripeness, which is conditioned by the reduction of the number of leaves, will be always accompanied by a decrease in the yield of green mass. Meanwhile, it is desirable to have high-stalked varieties and hybrids with a large number of leaves, and at the same time sufficiently early-ripening, for agricultural production. This problem can be solved only by means of reduction of the heat requirement of corn.

One should strive to achieve that the high-stalked, many-leaved varieties would develop in the non-chernozem zone at the

* Lines or simple hybrids, cultivated in southern regions and having 15-16 leaves, must be utilized as the paternal forms.

same rate as in the south, where they succeed in attaining milk-wax stage of ears during 90 to 100 days after the appearance of sprouts. But for this purpose it is necessary that the early-ripeness be conditioned not by the reduction in the number of leaves, but by acceleration of the rate of their emergence under conditions of the insufficiency of heat. Selectioners of the non-chernozem zone used various methods, particularly, a method of selection of early-ripening plants of many-leaved southern varieties in order to obtain early-ripening forms, having a high yielding capacity of the green mass. Since each variety of corn represents a complex population, it is always possible to detect plants, which differ in ripeness and deviate from the basic type. It was succeeded by means of repeated selections to obtain forms that are considerably more early-ripening than the initial variety. But at the same time, simultaneously with the increase of early-ripeness, occurred the reduction of the number of leaves and the reduction of the yielding capacity of the green mass, connected with it. Thus, in the selection for early-ripeness in the variety Partizanka the period from the appearance of sprouts to flowering has been reduced by 13 days, the number of leaves decreased to 14-15 from 16-17; and in connection with this the yield of green mass was reduced from 247 to 183 c from one hectare. It would seem that this problem could be solved with the aid of hybridization of early-ripening Siberian varieties with the many-leaved southern varieties. But it proved in practice that the thus

obtained hybrids occupied by their characteristics, an intermediate place between the parental varieties (table 5). Thus, in crossing variety Minusinka, which has 10-11 leaves, with the variety Minnesota 13 extra, which has 16-17 leaves, a hybrid with 13-14 leaves was obtained. The intermediate length of the vegetative period corresponds also to this number of leaves; it leans only very slightly to the side of the early-ripening parent. And the cause becomes understandable if one takes into consideration that the rate of the emergence of sequential leaves in early-ripening and in late varieties is practically similar; and that the early-ripeness of Siberian varieties is conditioned not by the speed of appearance of leaves, but by their smaller number.

During direct training of corn for increasing its cold-resistance different methods were used: extra early plantings into cold soil, the germinating seeds were "hardened" in the snow and in refrigerators; selection of quickly germinating seeds was conducted under conditions of artificially reduced temperature, and so on. These works have not as yet produce^d any practically appreciable results, although, undoubtedly, there exists a possibility of reducing the heat requirement of corn. This is shown by the variations in the characteristic of cold-resistance within the limits of a variety, as well as among the individual [Begin p.32] varieties. A confirmation of this possibility is found in the results of work of some foreign plant breeders, who succeeded in cultivating corn varieties, which are able to germinate at a temperature of 5-6°. The problem of cultivation of

cold-resistant varieties and hybrids of corn must be solved since it is of great production importance.

Table 5

Characteristic of foliation and of the length of vegetation period in different varieties and hybrids of corn (1957)

Varieties and hybrids	Number of days from the appearance of sprouts to tasseling			Mean number of leaves		
	In a hybrid	In the mother variety	In the father variety	In a hybrid	In the mother variety	In the father variety
Sibirskachka X Minnesota 13 extra	56	54	76	12.3	10.8	16.6
Minnesota 13 extra X Sibirskachka (Minusinka)	65	76	54	14.0	16.6	10.8
Slavgorodskaya 270 X Minnesota 13 extra	62	56	76	13.7	12.4	16.6
Minnesota 13 extra X Slavgorodskaya 270	65	76	56	13.8	16.6	12.4
Pervenets X Minnesota 13 extra	61	57	76	13.1	12.1	16.6
Minnesota 13 extra X Pervenets	62	76	57	13.7	16.6	12.1
Pervenets X Severo-Osetinskaya	62	57	81	15.7	12.1	18.3
Severo-Osetinskaya X Pervenets	67	81	57	13.6	18.3	12.1
Pervenets X Partizanka	61	57	76	13.6	12.1	17.0
Partizanka X Pervenets	65	76	57	14.5	17.0	12.1
Slavgorodskaya 270 X Partizanka	64	56	76	14.5	12.4	17.0
Slavgorodskaya 270 X Severo-Osetinskaya	60	56	81	13.3	12.4	18.3
Sibirskachka X Partizanka	66	54	76	14.5	10.8	17.0

It is also possible to influence the length of the vegetation period of corn with the aid of agrotechnical methods besides the various methods of selection. Having correctly built up the

agrotechnique of cultivation, it is possible to produce favorable conditions for a fuller and a more effective utilization of heat by the corn plants. The temperature regime of soil in the zone of activity of the root system is improved considerably by a proper choice of a field to be used under corn. According to data of Academician of VASKHNIL [All-Union Academy of Agricultural Sciences imeni V. I. Lenin], V. P. Mosolov, a field, having a slope to the south of only 1° , receives the same amount of heat as does a field with a horizontal surface which is situated 100 km to the south. Difference in the temperature between north-western and southern slopes, at a similar steepness, comprises $6-7^{\circ}$ in the air and up to $5-7^{\circ}$ in the soil at the depth of 1 cm. Owing to this, the soil is ready earlier on the southern slopes, and one can start planting corn on them earlier and obtain a yield of ripe ears earlier.

Corn grows and develops faster on soils containing 60-80% sand, than on clayey soils. This is explained not only by a better air regime of these soils, but also by their higher temperature. Difference in temperature [Begin p.33] of the sandy loam and of the clayey soil during the course of the entire vegetation period comprises $1.0-1.5^{\circ}$.

The following results were obtained, in 1956, in comparing the development of corn variety Nemchinovskaia on various soils (table 6).

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Table 6

Rate of development of corn on various soils

Soil	Planting	Sprouts	Tasseling	Milk-wax stage	Yield of green mass (in c/ha)
Turf-podzol sandy loam	May 20	June 2	July 16	Sept. 3	320
The same, clayey	May 20	June 7	July 26	None	282

Planting on best and concise dates provides the obtaining of early and simultaneous sprouts; owing to this corn begins to vegetate earlier, its flowering proceeds during the warmer period of the summer. It is as important to determine the best depth for embedding the seeds: too deep an embedding not only leads to the weakening of sprouts, but also delays their emergence for several days. It is similar to a late date of planting in its negative results.

The thickness of planting tells especially sharply on the yield of ears; therefore the timely thinning and leaving in a hill of the proper number of plants is one of the most important conditions for normal development of corn.

A very important condition for normal development of corn is its being provided with all the necessary elements of mineral nutrition. As it already has been pointed out, high fertility of soil can decrease the negative effect of heat deficiency to a large degree. Especial consideration must be given to supplying corn with a sufficient amount of phosphorus during the entire period of vegetation.

Growth and development of corn are in a very close connection and dependence. Therefore, all these agrotechnical measures,

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which help the growth of corn, produce also a favorable influence on its development.

Protsenko, A. E.

Virusnye bolezni kartofelia.

[Virus diseases of potatoes].

Zashchita Rastenii ot Vreditel'ei
i Boleznei, vol. 4, no. 3, p.30-32.
May/June 1959 421 21.

(In Russian)

Virus diseases (degeneration) of potatoes reduces drastically the yield in individual regions and in the end make a renewal of the seed material for this crop necessary. The following are the known basic types of degeneration of potatoes caused by different viruses.

Crinkle mosaic. The leaves of the infected potato branch are crinkled (bulging between the veins), have turned down edges and fragile petioles. Sometimes light-green spots are noticeable on the leaf blade. Growth is inhibited and the tubers are small and produce an unhealthy progeny. The disease is caused by one or by several viruses.

Mottled mosaic. Light-green spots on leaves are well visible in light. The form of the leaf is sometimes slightly changed. Depression of the branch similar to that in leaf-roll mosaic has not been observed, but in following years there may develop dwarf plants from its tubers.

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Streak mosaic. Necrotic streaks [appear] on the veins and frequently also on the petioles of leaves and stems. The petioles are fragile and the leaves fall off - at first the lower ones and later also the upper ones. Sometimes mottled mosaic is observed on the young leaves. In some instances diseased and healthy stems grow from the same tuber (but from different eyes).

Dwarf leaf-curl. Inhibited growth of the plant, crinkled, curly leaves, often resembling distinctly pronounced leaf-roll mosaic. The tubers are small.

The gothic disease or the spindle tuber. Growth inhibition of plant. Upright stems, narrow, crinkled leaves slightly curly and standing upright, with a coloring paler than that of healthy leaves. The tubers are elongated and spindle-shaped.

It is characteristic of virus diseases to have certain common properties of which the principal ones are: the character of their distribution on the planting area, their ability to infect healthy plants and the influence of climatic and soil conditions upon their manifestation and distribution.

Plants infected by virus diseases are usually distributed more or less evenly on the potato field regardless of their number. In case of disease caused by deficiency of some element of nutrition (potassium, calcium, magnesium etc.), or by the presence of injurious elements in the soil (which happens very rarely), its symptoms are pronounced in approximately the same degree in all plants on either a large or ^a small area. [Begin p.31].

Virus diseases of potatoes, as well as of other plants, are contagious, i.e. they can be transmitted from diseased to healthy plants by various means. One of these means is mechanical transmission. Under field conditions, some types of infection are transmitted from diseased plants to healthy ones by contact between the leaves (in windy weather or during treatment of interrows). They can be transmitted by various insects that infest potatoes, for instance aphids, cicada, caterpillars, and by the knife used to cut tubers before planting. Thus, in one of the experiments conducted at the Institute of Potato Economy, a knife employed preliminarily to cut potatoes off a plant infected by mottled mosaic was used to cut tubers before planting. Consequently, when the plants grown from tubers infected by such means were examined with the aid of an electron microscope, it was found that out of 49 plants only 3 had no viruses, and out of 44 controls there were 38.

In another experiment in which 47 healthy plants were infected by means of rubbing their leaves with the juice of diseased plants, all proved to be infected. Among controls 37 out of 47 were free from the virus.

The X-virus of potatoes is transmitted only by mechanical means. Others, for example, the viruses of leaf-roll and yellow top are distributed only with the aid of insects - aphids, cicada and others. All viruses are transmitted by seed [posadochnyi] tubers. Hence, it is understandable why the situation becomes

more threatening when the seed material is infected.

Virus diseases of potatoes are characterized by one more peculiarity. A considerable time interval - from 20 to 40 days and longer - passes from the moment of infection until the appearance of notable symptoms. Hence, external symptoms of the disease usually are not visible the year in which the infection of plants occurred and often not even in the following year. They can, however, be detected either serologically, or by infection of indicator plants, or with the aid of an electron microscope. In the latter case, thread-like particles - viruses - are visible among the formless pieces of the destroyed portions of plant cells when magnified 10-20 thousand times.

Nor do viruses enter tubers from infected leaves immediately, but [only] after 30-40 days. Therefore, it is possible to obtain healthy tubers, if the leaves are infected late.

It has also been demonstrated experimentally that the virus need not [necessarily] be in all portions of the tuber, nor in the same quantities. It is considerably less in the heart than around the eyes, and, in some cases, not in all eyes, for example, when plant infection occurred during the second half of vegetation.

The development of virus diseases of potatoes is greatly influenced by temperature, soil moisture, weather conditions and fertilizers.

For some types a temperature between 20 and 30 degrees [C] is most favorable. Thus, in one of our experiments, symptoms of

infection by the X-virus of potatoes in tobacco disappeared after the plants were placed under conditions of temperature above 30°. Control plants that were left at 20-25° had well pronounced symptoms of the disease and in the end perished. Potato tubers (although infected by virus diseases) grown during a cold and damp summer produced plants the following year that were either externally slightly infected, or had no infection symptoms whatever. Conversely, after a hot and dry summer there are more diseased plants and the degree of disease is more pronounced. On soils with excess nitrogen virus diseases manifest themselves to a higher degree and reduce the yield to a greater extent than on soils with a normal ratio of nitrogen, potassium and phosphorus fertilizers.

[illus.]: Potato plant infected by dwarf leaf-curl

It follows from the above said that measures against virus diseases could be [Begin p.32] sufficiently effective if they were applied in time, but the results will tell only the following year. Hence primary attention should be paid to seed material. If it is healthy, it guarantees the absence of virus diseases and, consequently, a normal yield.

It must be kept in mind that measures used against virus diseases are simultaneously applied in the control of potato diseases such as black leg, ring rot, Fusarium rot [or blight], Rhizoctonia etc. They all may be summed up within the following complexity, first of all for seed plots of kolkhozes and sovkhoses. Planting of uncut tubers of medium size and the proper shape characteristic

of the variety. In the event circumstances make cutting necessary, then the knife must be disinfected every time in a 5% formalin solution.

All plants showing symptoms of virus infection and other diseases must be removed before the leaves close. Weeding out [removal of diseased plants] must be repeated during flowering. This is one of the basic measures.

The harvest must be gathered as early as possible - 2-3 weeks after flowering - to prevent the penetration of viruses from leaves into tuber, if the leaves were contaminated by plants that had been infected but showed no symptoms of disease. Although the yield under these conditions will be lower as regards weight, ~~yet~~ there will be considerably less infected plants, and the yield obtained from these the following year will be higher than that obtained from larger but virus infected tubers.

Excessive fertilizing of the plot with nitrogen must be avoided, and sufficient potassium and phosphorus is to be applied. Areas intended for seed plots must be selected to the extent possible with a great deal of moisture, or else artificial irrigation is to be carried out. Practice has established that in colder northern regions and in mountainous regions potatoes suffer less from virus diseases.

vg/A

Churaev, I. A.

K probleme bor'by s koloradskim zhukom.

[Problem of Colorado beetle control].

Zashchita Rastenii ot Vreditel'ei i Boleznei
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(In Russian).

The Colorado beetle is one of the most dangerous pests of the potato crop. After invading France for the first time in 1918 from America, this pest has by now spread throughout many European countries covering a territory equivalent to 2 million square km. In Poland, Czechoslovakia, Hungary and in part in Rumania it has come close to the border of the Soviet Union.

To prevent losses of the potato yield on territory where the Colorado beetle is distributed, the countries have been forced to conduct from one to three chemical treatments annually which incur large expenditures. The potato yield left unharvested due to injuries inflicted by the Colorado beetle amounts to about 30% in France and to about 15% in Western Germany. If the minimum losses were calculated only at 10%, then failure to prevent the spreading of the pest on the territory of, for instance, the Belorussian SSR could result in a loss of over 500 million rubles, and [calculated on the scale of the [entire] USSR - about 6 billion rubles annually.

Decisions adopted by the 21st Congress of the KPSS [Communist Party of the Soviet Union] have provided for a considerable in-

crease in potato production and, hence, the protection of the given crop from pests and diseases has acquired specially great importance. Taking into consideration the danger that the Colorado beetle presents to potato growers, the Ministry of Agriculture USSR took measures during the entire period of the post-war years that were bound to play a positive role in preventing the distribution of the pest on the territory of our country.

In the USSR, the Colorado beetle was found for the first time in 1949 in the L'vov Oblast' and as a result of the measures that were taken it was completely eradicated. Since 1953 it annually began to penetrate into territory of the Kaliningrad Oblast' and also into the Lithuanian SSR and the Brest and Grodno Oblasts. The first mass flight of the pest in the same direction was registered in the year 1956. In the Kaliningrad Oblast' it was found in 16 districts. As a result of the extermination measures conducted, the number of foci decreased in 1957 more than 10 times as compared with 1956. It could be expected that the results of this invasion [zalet] would be completely eradicated in the next year or two. However, due to a number of factors that manifested themselves in 1958 there occurred an invasion of the Colorado beetle that was second in sequence but in larger masses into the Transcarpathian and Dragobych Oblasts from the direction of Hungary and, in part, from Czechoslovakia, and into the Kaliningrad Oblast' and the Lithuanian SSR from the direction of the Baltic Sea where it had been carried by hurricane winds from Polish and German territory.

The pest was detected in 711 populated localities that bordered on Poland, Czechoslovakia, Hungary and Rumania where 5320 foci were found. As a result of extermination measures conducted in 1958, by now, a considerable portion of them has been exterminated, but, taking into consideration the proximity of the foci on territory of the countries indicated, a second invasion of the beetle into the USSR must be feared. Hence, the magnitude of the extermination and prophylactic measures conducted in the control of this pest in the borderline districts in the current year must not be below that of last year.

Ten-year's experience has demonstrated that by means of systematic observations of the appearance of the pest and by using chemical agents against it, its settling can be prevented and the foci found can be completely eradicated. This is a task of State importance, and agriculture has at its disposal everything needed for its accomplishment. [Begin p.44]. Now, the main thing is that the available means be properly utilized in the coming campaign.

First of all it is necessary to raise the role and the responsibility of the managers and agronomists of kolkhozes and sovkhoses and also of the owners of individual orchards in carrying out control measures for the Colorado beetle. To have the work organized the best way, it is desirable to recommend to farms that they provide technicians or brigadiers for the protection of plants who periodically will attend a refresher training course.

Practice of past years has demonstrated the exceptional importance of the participation of the population in this matter. It suffices to say that a large portion of the foci is always detected by the population itself while tending the plantings. This is why in organizing the inspection of plantings, one of the leading places was assigned to the participation of wide strata of the population within the system of measures for 1951 adopted by the All-Union Conference on the Colorado Beetle held in February of the current year.

It is necessary to unfold more widely propaganda on the injurious nature of the beetle and on measures for its control orally as well as in printed matter. The responsibility of the owners of crops should also be increased in case they show an attitude of negligence regarding measures conducted by the State.

The system of measures provides for the implementation of control inspection of potato plantings by the brigade [team-work] method in all raions in which the pest was found in 1958, and also within a 200 kilometer belt from the farthest eastern foci. Special attention has been called to the quality of these inspections, hence, it is absolutely necessary that farm agronomists and technicians (brigades [teams]) take part in them. Eradication of the foci of the pest and formulation of documentation must be accomplished under their immediate supervision.

Prophylactic spraying of potato plantings with chemical preparations that retain their toxic action on the leaves of plants

for a long time are of great importance. It is recommended that MME [a 20% concentrated mineral oil emulsion (?)] DDT in a 0.3% concentration (according to the active element), or DDT paste in a 0.4% concentration be used for this purpose at the consumption rate of 400-600 liters/ha of the working liquid.

Taking into account the duration of the toxic action of the preparations and also the factor of growth of the foliar mass of the potatoes in raions infested by the Colorado beetle (with the exception of the mountain raions of Transcarpathia and the Drobych Oblast', and also raions in which only isolated foci were found in 1958, where only one spraying is carried out), it is recommended that two treatments be carried out: the first - during the period of mass appearance of larvae of the 1st age group which coincides with the continued mass exit of the beetles from the soil after overwintering, the second - 10-15 days after the first. Furthermore, it must be taken into account that the objective can be reached only if the quality of the work is high. Control inspections carried out with a view to detection of the Colorado beetle must simultaneously represent a checking of the quality of the prophylactic spraying in progress.

Under conditions where the numbers of the pest are small, the correct selection of dates on which inspection and chemical treatments are to be conducted is a factor of great importance. The development of a method insuring a promising forecast of these dates will be [entrusted] to VIZR [All-Union Institute of Plant Protection] as a task of first importance.

In organizing and in implementing measures for the prevention of the distribution of the Colorado beetle, specialists of plant protection and quarantine will be called upon to perform an important role. The direction of the work in oblasts and raions will be realized through the oblast' agricultural administrations and the raion agricultural inspection services by enlisting detachments for pest control at RTS [Tractor Repair Stations]. Hence, it is very important to strengthen these detachments with specialists and to supplement their staffs with the services of an entomologist. It is also necessary to raise the role of quarantine inspections and to increase their responsibility for the quality and timeliness of the work being conducted. In accomplishing all of his activities, the quarantine inspector of a raion must maintain contact with the district agricultural inspection services and with the district executive committees.

Pursuant to the decisions adopted by the 9th International Conference on Quarantine and Plant Protection, there now have been created active bilateral, mixed committees whose tasks include the checking and inspection of Colorado beetle control in the borderline districts of the interested countries. The data of the committees will undoubtedly perform a positive role.

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Kriachko, Z. F.

Opyt bor'by s koloradskim zhukom na Ukraine.

[Experience in Colorado beetle control in the Ukraine].

Zashchita Rastenii ot Vreditel'ei i Boleznei, vol. 4,
no. 3, p.45-47. May/June 1959. 421 21

(In Russian)

In recent years the appearance of the Colorado beetle in USSR territory has been noted with increasing frequency.

Between 1949 and 1957, foci of the Colorado beetle in the Ukraine were found in seven districts of the L'vov, the Volhynia [Volyn] and the Transcarpathian Regions. These include also the focus in the village Khitreika, Nesterov District, L'vov Region, that had attacked 110 potato fields on which 35 kg of the pest were gathered in different stages of its development.

All foci were eliminated. Nonetheless, in the spring of 1958, the Colorado beetle again appeared en masse on territory of the Transcarpathian Region: in 4816 fields of 452 populated localities were gathered over 630 thousand beetles, larvae and ovipositors. Individual specimens were found in the Volhynia, L'vov and Stanislav Oblasts. It has been established that the basic reason for this [invasion] was the flight of beetles from Hungary and Poland that had been prompted by atmospheric conditions.

Chief State Inspection Service for Plant Quarantine in the Ukrainian SSR.

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To confirm this fact we can cite the following [evidence]: 61% of the beetles were found in places where potatoes were stored in earthen mounds [burty] and on tubers brought to the field for planting; 8 beetles were found on the clothes of a kolkhoznik who rode on a motorcycle through a village at the Hungarian boundary, beetles were found also on grape clusters [kol'iakh], in the forest, in ensilaging pits, in baskets with potato tubers and in many other unusual places.

All of these facts indicate that the search for the pest and measures for the elimination of its foci must be continued, since it obviously cannot be fully uncovered within one year.

A study of these problems has demonstrated that the developmental conditions of the Colorado beetle in Transcarpathia and other western districts of the Ukraine are extremely varied: in the plains there are two complete generations and some years even three. In the year 1958, in the Transcarpathian Region, for example, the first overwintered beetles in the lowland districts were noted on May 11, the first generation on June 19 and the second generation on - August 15. As a rule, the beetles that left the soil mated after 2 to 3 days and began to lay eggs.

In the mountain districts of the Transcarpathian Region, as well as in the L'vov, Volhynia, Drohobich and Stanislav Regions the beetle develops only one generation. Thus, in the Volovets (mountain) District of the Transcarpathian Region the development of the first generation ends at the end of July or at the beginning of August. The young first generation beetles that have developed

during this period nourish themselves intensively, but they do not mate and do not lay eggs. At the end of August they commence to enter diapause. In 1958, all beetles went underground on September 20th.

In lowland districts, overwintered beetles usually enter diapause after July 9, those of the first generation after August 13 and of the second generation - September 15.

[illus.]: Spraying of self-sown potatoes among the young crop of maize against the Colorado beetle on the kolkhovskiy imeni Lenin, Velikoberezniansk District, Transcarpathian Region

In order to resolve the problem as to the desirability of carrying out inspection and chemical treatments of potato crops, we investigated the food specialization of the beetle and its larvae. It was established that during the spring period the beetle, in addition to potatoes, injured the seedlings and young plantings of tomatoes, eggplants and pepper. Neither the beetle nor its larvae injure tobacco (the Sobol'chskii local variety).

We consider that inspection of potato plantings for the purpose of detecting foci of the pest, carried out in good time, is the main link in its control. In the Ukraine, in the spring of last year over 4500 district and rural organizers were prepared at special seminars held in the western regions, and later with the aid of the latter over 200 thousand mass inspectors were prepared. 23.8 thousand pamphlets, 77.8 thousand posters, 385 thousand leaflets published by the State Inspection [Service]

were distributed among the population. 91 talks were given over the radio, films were shown 197 times and 266 articles were published in newspapers about the importance and the measures of pest control.

Careful inspection was made of all storage places (caves [burtovanie]) and of self-sown potatoes, [Begin p.46] [as well as] of nurseries growing tomato, eggplant, pepper and tobacco seedlings. Here were gathered and destroyed over 160 thousand beetles and their ovipositors.

Potato plants were inspected as sprouts appeared by the farmers themselves and by owners of [individual] plots no less than once a week and, apart from this, inspections were carried out everywhere by brigades selected from the population, in particular by school boys under the supervision of agronomists and organizers.

During the period that began with the invasion of the beetles and lasted up to the appearance of larvae of the 4th age group (from May 24 to June 25) were conducted two (one after another) continuous inspections of potato plantings, and later two more (in the lowland area of Transcarpathia - three) inspections: one on June 30 - during the period when beetles of the first generation emerge from the soil in the lowland districts and larvae of the 3rd age group appeared in mountain districts, the second one on July 17 - during the period in which larvae of the 2nd and 3rd age groups appear, and the third one on August 15 - during the period of mass emergence of second generation beetles in lowland districts and of

first [generation beetles] in the mountain districts of Transcarpathia.

Potato plantings in the Transcarpathian and Drogobych Regions and in the boundary line districts of the L'vov and Volhynia Regions were simultaneously subjected to continuous prophylactic spraying or dusting with insecticides.

Chemical treatments of plantings were conducted twice, and in the lowland districts of the Transcarpathian Region three times: the first one from May 18 through June 5 - as sprouts appeared (the period that coincided with the settling of overwintered beetles and mass hatching of larvae); the second one from the 5th to the 15th of June (in mountain districts - mass hatching of larvae, and in lowlands - appearance of first larvae of the 4th age group), the third one - from July 15 onward, during the period of a mass exit of first generation beetles from the soil - in lowland districts, and mass hatching of larvae of the 3rd age group - in mountain districts. In a number of farms in the Beregovsk and other district it was necessary to spray 4 times.

The poisonous chemicals used were the following: 50% DDT paste in a 0.8% concentration, 20% MME [mineral oil emulsion], DDT in a 1.5% concentration. The first one to be tested was polychloropinen (a 65% concentrate). In sunny weather this preparation in 0.75% and 1% concentration (according to the preparation) proved highly effective: 100% beetles and larvae of all age groups died on the 2nd day after the treatment. Converted to a one-time treatment, a total of 231 thousand hectares of potato

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plantings were sprayed and dusted with poisonous chemicals.

This work was organized by detachments of Tractor Repair Stations (RTS). Each detachment was composed of 4-5 brigades that had at their disposal 2-3 tractors with mounted sprayer-dusters ONK-A, 2-3 horse or motor drawn sprayers OKM, 30-50 knapsack apparatuses, one truck and 1-2 tank-cars.

A brigade was composed of a corresponding number of tractor operators, auto-operators and hose operators, 2 laborers, one technician, an [automobile] driver and a recorder. The brigade was headed by an agronomist. When it arrived at a populated locality it sprayed all potato plantings regardless as to whom they belonged. The work was carried out at the expense of the Government. The detachments were paid in money according to calculations confirmed by regional agricultural administrations. On the average, treatment of one hectare including the cost of the poisonous chemicals came to 48 rubles and 60 kopeks.

The foci (place where the plants injured by the pest are located and the area within a 10 meter radius), depending on the stage the pest is in that is found on them, were divided into two groups, since the method used to eradicate them is different. The first group - with larvae of the 3rd and 4th age groups found on the surface of the foci, or with larvae, pupa and beetles in the soil. All potato plants found on such a focus and within a radius of 1 km were sprayed with a 0.8% solution of a 50% DDT paste (as per the preparation); then they were gathered with the tubers, and a 25%

benzene hexachloride dust on phosphorite meal was introduced into the soil at the rate of 15 gm per square meter and covered with rakes to a depth of 2-3 cm.

The second group - with beetles, ovipositors and also isolated larvae up to the 3rd age group were found only on plants and on the soil surface. Here [the treatment] was limited to spraying the plants with the indicated poisonous chemicals.

Within a period of no less than 10 days each focus and the surrounding plantings of potatoes and tomatoes were observed every day. When living beetles and larvae were found then measures for the eradication of foci were repeated.

The use of the indicated system in the Colorado beetle control permitted eradicating completely isolated foci in the Volhynia and L'vov Regions and to localize and eradicate their fundamental quantity in the Transcarpathian and Drogobych Regions. Thus, of the foci found earlier in the Transcarpathian Region, some were left on only 426 farms, i.e. 10%, while the pest was decreased 97%. [Begin p.47]. Supplementary eradication measures have been conducted and it appears certain that they will produce positive results.

Taking into consideration the probability that there are places in which foci have remained undisclosed, plans to repeat measures against the beetle during the current year are under way. It is planned to carry out one continuous prophylactic spraying (in the

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lowland districts of Transcarpathia - two) during the period in which overwintered beetles settle down, including the development of larvae up to the 3rd age group.

[Signed] Z. F. Kriachko

Chief State Inspection Service
for Plant Quarantine in the
Ukrainian SSR

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Mel'nikov, N. N.

Novyi gerbitsid - simazin.

[New herbicide - Symazine].

Zashchita Rastenii ot Vreditel' i
Boleznei, vol. 4, no. 3, p.53.
May/June 1959 421 21

(In Russian)

In recent years Swiss researchers have found a new group of active herbicides - derivatives of symm-triazine of which special interest is held out by 2-chlor-4,6-bis (ethylamino)-symm-triazine which has been given the trade-name of Symazine.

It represents a white crystalline substance with a melting point of 227° [C] (a technical preparation usually melts at 222°-224°), is very slightly soluble in water and only slightly soluble in methyl alcohol and chloroform. In room temperature Symazine is resistant to the action of diluted aqueous solutions of alkalis and acids which destroy it by boiling by means of splitting off the chlorine atom. It can be destroyed also when heated with concentrated sulfuric and nitric acids, and it is non-explosive. It disintegrates slowly in a soil solution: its residual action lasts from a few months up to 2 years. This permits utilizing it in the control of annual weeds among the young crop of plants the root system of which is embedded deeply.

Symazine is [only] very slightly toxic for man and animals

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(the minimal lethal dose for experimental animals is 5000 mg/kg of living weight).

When plantings are treated with this preparation at the rate of 1-2 kg/ha, it destroys a large number of weed species for practically the entire vegetative period, and when used at the rate of 6-8 kg/ha, then weeds such as European bindweed, couch grass and others are also destroyed. According to data of Swiss researchers who work in the laboratory of the Firm of "Geigy", Symazine used at the rate of 3.75-10 kg/ha suppresses the development of monocotyledonous as well as dicotyledonous weeds for a long period - for over 5 months.

The aftereffect of the preparation is also long lasting. On fields treated with this preparation at the end of April 1955 (10 kg/ha), the following plants had injuries more than a year later (in June and August of 1956): celery [Apium L.], leek [Allium porrum], wheat, oats, barley, rye, peas, beans, carrots, radishes, turnips, red clover, alfalfa, vetch, flax, and hemp; when the preparation was used at the rate of 5 kg/ha, the injured plants included wheat, oats, barley, beans, carrots, radishes and sugar beets; when 2 kg/ha were used, then none of the above listed crops had any injuries.

Maize possesses a specifically high resistance to the given preparation, even when applied at the rate of 10-15 kg/ha. In the control of weeds on maize plantings, Symazine is usually recommended in doses of 1-3 kg/ha. But the sensitivity to this pre-

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paration of the crop that is to follow maize must be taken into consideration, since large doses of the preparation can later have an injurious influence upon it.

Attention should be paid also to a study of the possibility of utilizing this preparation and its closest analogue - chlorazene [2-chlor-4,6-bis (diethylamino)-symm-triazine] in the control of weeds in plantings of cotton and certain other crops. Although the nature Symazine action upon plants has not been clarified conclusively, there are reasons to assume that it is responsible for a disturbance of photosynthesis and a discontinuance of the accumulation of starch that occur within the plant (Coleus Blumei and Tropaeolum).

The high resistance of maize to Symazine has been explained by the presence of an enzymic system in this species of plants that hydrolyses Symazine rapidly by splitting off the chlorine atom and converts the preparation to a very slightly toxic 2-oxy-4,6-bis (ethylamino)-symm-triazine.

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Bel'kov, V. P. and Shutov, I. V. (Reviewers)

Novaya kniga o khimicheskom metode bor'by s sorniakami [N. E. Dekatova. Khimicheskie sredstva s sornoj rastitel'nost'iu v lesnom khoziaistve. Goslesbumizdat, 1958].

[New book on the chemical method of weed control] [Chemical means of weed control in forestry].

Zashchita Rastenii ot Vreditel'ei i Boleznei, vol. 4, no. 3, p.61. May/June 1959. 421 21

(In Russian)

[The author of] the book examines in succession the importance of the control of weeds and of undesirable plants. He describes the more widely distributed herbicides and arboricides and the methods used in exerting chemical action, and cites fairly detailed practical instructions for their application to forestry. In each specific case the author cites accounts of economic effectiveness. On the whole, the book is useful to production and may serve as a reference work for students.

It, nonetheless, has its shortcomings. Some controversial and ill defined problems received a one-sided elucidation; it contains [also] some obsolete recommendations that could disorient the reader.

For example, a great deal of attention has been given to chlorates and their extensive use in nurseries and on clearings has been recommended. Meanwhile, the author himself points out

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that detoxication of heavy soil varieties (there is a preponderance of such soils in the Taiga zone) takes place slowly after they have been treated with chlorates. This eliminates the possibility of utilizing such plots under crops even a year after the chemical treatment. The given circumstance should have been noted more distinctly and it should have been emphasized that chlorates can be used only on light soils.

The author's recommendation that sodium arsenite be used in chemical drying of defective aspen causes one to wonder, inasmuch its high toxicity for man and useful animals is known. And the observance of the rules of safety techniques under forest conditions is very difficult.

In examining the new herbicide of uniform action - ammonium sulfamate - the author gives the same kind of advice as he did for chlorates. It is impossible to agree with this, since sulfamate, distinct from chlorates acts upon the plant primarily through its surface organs and not through the soil. Hence the author's indication that sulfamate can be used in weed control in its crystalline form is incorrect (p.40).

The suggestion that soil in arid regions can be watered before and after weeds have been treated with sulfamates is ungrounded (p.91): it can reduce the importance of the chemical treatment to nothing.

The effect of sulfamates upon weeds of the rhizome (surface beach grass, couch grass and others) is slight. Therefore it is

impossible to agree with the author's recommendation that this preparation be used against perennial weeds on fallow plots of nurseries (p. 91) and on clearings against beach grass in general (p. 40), because this could lead to the spreading of the worst kind of weed - the surface beach grass - and to choking of crops.

As regards ammonium sulfamate, it must be noted that this compound is not only an effective herbicide but also an arboricide of continued action. With aid of this compound it is possible to bring about the drying up of brushwood and of woody shoots of various composition, height and age. Hence, the indications in the book that sulfamate could be used only in the control of annual scrub (p.106) is not in conformity with the facts.

Further the author indicates that for the purpose of thinning out of the canopy of alder, birch and hazelnut in coniferous-green-wood young forest growth [molodniak] one can use sodium and amine salts 2,4-D, 2,4,5-T and 2M-4X. With reference to this, it must be noted that in the given case the use of sodium salts is inexpedient, since they are inconvenient for application [obrashchenie], penetrate into plant leaves slowly and are readily washed off by rain. For the care of the composition of mixed young forests growth, amine salts 2,4-D (preparation 2,4-DA) should be used first of all. This compound penetrates into plant leaves more rapidly and causes not only the drying of birch and alder, but even the thinning of aspen.

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The optimal time for spraying under conditions of the north-western regions are the dates from July 11 to July 20, Later in the season (up to August 15, as is indicated in the book) it produces extremely puny results.

The author also points out that in case there are insufficiently heeled-in sprouts [nedorub] and seedlings in the young forest stand, aerial spraying must not be conducted, because the flight altitude of the airplane will exceed 10 m. The given requirement unjustifiably limits the circle of objects [that benefit] from the use of the aerial-chemical method of tending a young forest stand, because insufficiently heeled-in sprouts and seedlings are found practically everywhere. In fact, aerial spraying of a young forest stand can be conducted even if the plane flies at an altitude above 10 m - it merely increases somewhat the loss of the chemical in the air.

The principal comment about the book must be made regarding the instructions given for the use of the derivatives 2,4-D in the control of mosses - peat moss and polytrichum - cited on pages 50 and 102. The author recommends the same dosage of the preparation (7-8 kg/ha) for the indicated objectives without taking into account that polytrichum is more resistant to 2,4-D than peat moss. Consequently, the dosages should be differentiated.

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Korotkikh, G. I.

K istorii aviatsionnogo melkokapel'nogo opryskivaniia.

[History of aerial fine-drop spraying].

Zashchita Rastenii ot Vreditel'ei i Bolezn'ei, vol. 4,
no. 3, p.63. May/June 1959. 421 21

(In Russian)

At the present time, fine-drop spraying and aerosols have gained wide distribution in the USA and West-European countries. These methods are used with much success also in our country. The use of fine-drop spraying with poisonous chemicals of high concentration in the control of the Siberian silkworm^{*} was suggested for the first time in world practice in the Soviet Union. The turbine sprayer designed by V. F. Stepanov that is situated under the wings of the airplane Po-2A was utilized for these purposes. With the aid of this sprayer, in Eastern Siberia in the year 1940, 710 ha of larch infested with caterpillars of the older age groups of the silkworm were treated with a concentrated (10%) solution of sodium arsenite. More than 90% of the pest perished within 24 hours after the spraying.

In the Irkutsk Oblast¹, in 1947-1948, tests were conducted of the aviation fog-producing apparatus ATA designed by V. F. Stepanov and mounted onto the Po-2A airplane (see illustration). Consump-

^{*} Topics of reports of The Ecological Conference on Problems of Mass Propagation of Animals [and] the Prognosis [thereof], Sept. 15 20, 1940, part II. Izd. AN, Ukrainskoi SSR, Kiev, 1941.

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tion of a concentrated solution of technical DDT and benzene hexachloride [GKhTsG] at the rate of 12-15 liters/ha achieved high mortality of the caterpillars of the Siberian silkworm of the younger age groups (P. M. Rafes and others). Further, in the Kirovograd Oblast', an oil solution of technical benzene hexachloride was used against the pea weevil [Bruchus pisorum L.] at the rate of 10 liters/ha. This also was sufficiently effective (Z. V. Ivanova).

In the years 1950-52, D. F. Rudnev and M. A. Anfinnikov practiced fine-drop spraying with DDT oil solutions for the purpose of destroying forest pests and they also obtained positive results with a low consumption of the working liquid. In 1952, A. M. Churakov utilized ATA successfully over fruit plantings and against the acorn weevil [Balaninus glandium Mrsh.] in the Krasnodar Territory. Later A. I. Sadovnikov demonstrated that ordinary aerial boom sprayers can be used in treating a forest with concentrated solutions of poisonous chemicals.

The experience accumulated in our own country and abroad indicates that fine-drop spraying by the aerial method should be utilized in mass production with more determination, primarily in the control of forest and field crop pests.

[Signed] G. M. Korotkikh

Starostin, S. G.

Melkokapel'noe avioopryskivanie v bor'be so sveklovichnym dolgonosikom.

[Fine-drop aerial spraying in the control of beet weevil].

Zashchita Rastenii ot Vreditel'ei i Bolezn'ei, vol. 4, no. 3, p.19-22. May/June 1959. 421 21

(In Russian)

In USSR, annually, 1.3-1.5 mln ha of sugar beet plantings are aeriaily sprayed with poison chemicals, this comprises, approximately, half of all the area of chemical treatment for the control of the beet weevil. Such a role of aviation in this matter raises a problem of further improvement of methods of its work, raising of productivity, effectiveness and reduction of cost.

One of the means for solving this problem is the use of fine-drop spraying with highly toxic poison chemicals with a small expenditure of liquid. Possessing several advantages in comparison with aerial dusting (better retention of poison chemicals on plants, smaller dependence on the wind, smaller losses, and so on), aerial spraying is still behind it in productiveness. The basic cause is in large norms of expenditure of liquids. The problem of application of the fine-drop method of aerial spraying for the control of plant pests is not new, and its prospectiveness is evident. As it is known, in atomization of one and the same volume of liquid, the number of drops will be the greater, the

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smaller will their size be; therefore, the required density for covering the plants with poison chemical drops, as well as high effectiveness, can be provided even with a small norm of expenditure by using higher concentrations of poison chemicals.

One should mention that regardless of good reasons for changing to fine-drop aerial spraying, its practical application is connected with the necessity of overcoming many difficulties and, first of all, reduction of losses of liquid from evaporation and drift by wind of fine drops beyond the limits of the treated section. Experiments of GosNII GVF [Scientific Research Institute of the Civil Air Fleet] have shown that water suspensions of poison chemical solutions are of little use for the cited purpose: at the size of drops about 100 microns and the height of the flight of 5 m, not more than 60% of their number, that was ejected from the airplane, reached the earth; oil emulsions and oil solutions of poison chemicals are best for fine-drop aerial spraying: they evaporate slowly in spraying. [Begin p.20]

Spray nozzles of reduced cross section are used with outlets 1 X 5 mm; 1 X 2 mm and 1 X 1 mm in order to provide a finer breaking down of liquid in aerial spraying. The per second expenditure of liquid, caused by this reduction, is accompanied by the increase of the number of revolutions of the wind mill of the sprayer and by a considerable increase of pressure in the spray boom. Thus, in installing a set of sprayers with openings of 1 X 1 mm on a series sprayer of the airplane An-2, with the pump AM-42, the wind

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mill produced 5,000 revolutions per minute, and the pressure in spray booms comprised 5.2 kg/cm^2 , while in sprayers with openings of $2 \times 5 \text{ mm}$, that are ordinarily used for spraying beets at a medium dispersity, the number of revolutions fell to 3,600, and the pressure in spray booms to 2.6 kg/cm^2 . Whereupon the dispersity of drops was changed correspondingly. One should point out that a poly-dispersion system of drops, the size of which varies in wide limits from 10 to 400 microns and over in diameter forms in aerial spraying. The range of the size of drops was somewhat narrowed in utilizing sprayers with openings of small cross sections.

Poison chemical operating concen- tration	Liquid consump- (L/ha)	Sprayers		Pressure in spray booms (kg/cm^2)	Number of drops on 1 cm^2 of the surface	Aver- age diameter of drops "(mkr)" [micron]
		Amount	Cross sec- tion of the outlet (mm)			
10% emulsion of DDT	15	16	1X5	5.2	64.3	86.4
6% emulsion of DDT	25	28	1X5	4.8	103.3	117.9
3% emulsion of DDT	50	50	2X5	2.6	104.0	214.9
10% solution of technical DDT in diesel fuel	15	16	1X5	5.2	116.4	105.7

Data, cited above, is about dispersity of drops in aerial spraying of sugar beets for the control of beet weevils.

It is seen from the above cited figures that with the norm of consumption of liquid of 50 L/ha with ordinary medium-drop dispersion of liquid, or of 25 L/ha, but with a finer dispersion, the

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number of drops per 1 cm² of the sprayed surface is alike. The size of drops, in the last case, is smaller while concentration of the poison chemical is higher in them. But the density of the network of drops in the oil solution of DDT, with the consumption of 15 L/ha, proved to be higher than in the emulsion of DDT with the consumption of 25 and 50 L/ha. Ukrainian NIIZR [Scientific Research Institute for Plant Protection] and GosNII GVF conducted extensive works on studying fine-drop aerial spraying with low norms of liquid consumption for the control of beet weevil, in 1957 and 1958, at kolkhozes in Kiev oblast'. As it was expected, the obtained results were positive.

The following data from the kolkhoz "Chervonnyi zhovten'" of Starchenkovskii raion, Kiev oblast', in 1957, are cited as an example. Spraying was conducted from the airplane An-2. Consumption of the poison chemical at different norms of liquid was similar: "polikhlorpinen" [polychlorpinene] 1 kg/ha, and 20% of "MME" DDT [mineral-oil emulsion of DDT] 1.5 kg/ha.

Poison chemicals	Consumption of liquid (L/ha)	% of dead beetles
Polychlorpinene	25	96
The same	15	90
50% solution of polychlorpinene in diesel fuel	6	92
Polychlorpinene	50	95
DDT	25	89
DDT	15	83
DDT	50	90

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Approximately the same indices were obtained in 1958 at kolkhozes "Imeni Stalina", Smelianski raion, Cherkassk oblast', "Imeni Kuibyshev", Skvirskii raion, Kiev oblast', and at several other farms. In all, 35 thousand hectares of plantings were treated in the above mentioned oblast's by the method of fine-drop aerial spraying with a norm of consumption of 25 L/ha. It is also difficult to overrate its economic importance. Reduction of the norm of consumption [Begin p.21] of the liquid to 25 L/ha will increase the productivity of airplanes per flying hour by 30-40%, and the use of oil solution of polychlorpinene (per 5-6 L/ha) by two times; the cost of aerial treatment will be reduced by 35%, not taking into account the savings on the delivery of water and manpower, and many other expenditures. According to preliminary estimates, transfer to fine-drop aerial spraying of sugar beets with a norm of consumption of liquid of 25 L/ha will permit to save alone on the payment for the airplane work, transportation and manpower, counting 4 rubles per hectare, about 5-6 mln. rubles per year.

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Shmanenkov, N. A., Mel'nikova, T. S.,
Sokolov, I. A., and Kotliar, E. Iu.

Mochevina-chastichnyi zamenitel' belka v
ratsione doinykh korov^{*}.

[Urea (carbamide) as partial substitute for
protein in the ration of milch cows]

Vestnik Sel'skokhoziaistvennoi Nauki, vol. 4,
no. 4, p.58-63. April 1959. 20 V633

(In Russian)

Among the nutritious substances of feed proteins are of great importance because they comprise the foundation of cells of the animal organism. Conversion of feed proteins to body proteins occurs by means of complex biochemical processes: first of all by the digestion of fodder. Under the effect of enzymes of the gastro-intestinal tract the feed proteins undergo a hydrolytic decomposition into products of different degree of complexity - albumoses, peptones, peptides, amino acids. After absorption into the blood, these products of hydrolysis serve as the initial material, from which organism builds the proteins required by it.

^{*}Results of the work were reported at the Conference of the Bureau of the Department of Animal Industry (June 26, 1958) and at the Presidium of VASKHNIL (July 3, 1958).

Vsesoluznyi Nauchno-Issledovatel'skii Institut Konevodstva [All-Union Scientific-Research Institute of Horse Breeding].

Often in feeds, along with proteins, the cited products of their hydrolysis are present in a certain amount in a finished form, which can be utilized by the organism in the same manner as the product of digestion of protein substances. Thus, the animals build their proteins from products of hydrolysis of fodder proteins, the final link of which are the amino acids.

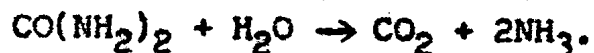
The amino acids, which do not take part in the building and renewing of animal proteins are oxidized. At the same time their amino groups separate out in the form of ammonia, and the nitrogen-free fragments either become converted to fats and carbohydrates, or are oxidized with the liberation of energy up to the water and carbon dioxide. Ammonia, as a toxic substance is decontaminated, being converted to urea, and, partially, becoming neutralized by acids with the formation of salts of ammonia, is taken out of the organism, in these two forms, with the urine.

Agricultural animals are able to synthesize certain amino acids from ammonia and nitrogen-free compounds of carbon, but, apparently, in very insignificant amounts. For a normal development of animals, it is necessary that ready amino acids be present in the feed proteins.

In nature, the initial synthesis of amino acids from ammonia and simple carbon compounds, and proteins from amino acids, is carried out by plants and certain forms of microorganisms. For animals the plants are the chief source of proteins. In this respect, a role of considerable importance is played by micro-

organisms living in the rumens of ruminants [Begin p.59] and which are able to build the proteins of their body from ammonia and products of conversion of nonprotein organic substances, and, in the first place, of carbons.

Mechanism of synthesis of amino acids, and then of body proteins by microflora in rumens of the ruminants has been studied very little so far. It is known only, that ammonia derivatives (carbamide, salts of ammonium), which are added to the feeds, can be utilized as sources of nitrogen for this synthesis. Nitrogen is utilized in the form of ammonia - NH_3 for synthesis of amino acids. Therefore, all the ammonia derivatives are subjected to hydrolysis at the beginning; as a result of this free ammonia is liberated. For instance, hydrolysis of carbamide (urea) occurs in the following manner:



A further stage can be the so-called reducing aminating of keto acids, which proceeds according to the scheme:



Individual characteristics of the amino acid, formed at this time, depends on the nature of the initial keto acid. Rumen microorganisms of ruminants build the proteins of their body from the obtained amino acids.

At the present time carbamide is used as a source of nonprotein nitrogen; it is synthesized by chemical industry from nitrogen of air, hydrogen and carbon dioxide according to the scheme:



Microorganisms, which reproduced in the rumen on the medium with carbamide, move to the abomasum with the feed, die in its acid contents, while their proteins are digested as a component part of the feed. The practical importance of this problem was determined after it was ascertained, that the microflora in the rumens of ruminant animals was able to synthesize proteins from nonprotein sources of nitrogen of industrial preparation in the amount of 25-30% of the total requirement of proteins by the animals. This, approximately, corresponds to that temporary deficit in feed protein, which is observed in many countries of the world, including also the Soviet Union. Hence, the interest, which is shown in this problem by representatives of agricultural science and animal industry practice of many countries, is understandable.

Soviet scientists B. N. Lavrov, O. I. Molchanova, A. N. Okhotnikova, I. S. Popov, I. M. Kuznetsov, and others made a valuable contribution to the study of the problem of utilizing non-protein sources of nitrogen in animal industry. At the present time this problem is being developed rather widely; whereupon the growth of chemical industry creates great possibilities for utilization of synthetic nitrogen compounds in animal industry.

We came to the following conclusions in using carbamide as a partial substitute of protein in the ration of ruminant animals: carbamide protein can substitute 20-30% of the ration's protein; degree of utilization of carbamide depends on the synthetic acti-

vity of the rumen microflora and quality of the basic ration of the animals. Giving of carbamide to animals in large doses can cause poisoning of the organism as a result of absorption of ammonia and excess of urea; in feeding carbamide, it is necessary carefully to mix it with the additional fodder, or with the feed of the basic ration, in order that it enter the gastrointestinal tract of animals gradually and evenly; the animals must be gradually trained for the consumption of carbamide; in zones, which are characterized by peculiarities in maintenance and feeding of ruminant animals it is necessary, before utilizing carbamide, to conduct a scientific-economic experiment with the participation of zootechnicians [Begin p.60] and veterinary surgeons. The most effective measures for feeding carbamide must then be developed on the basis of this experiment.

We think that insufficient studies of the mechanism for the utilization by animals of nonprotein nitrogen, including carbamide, is the chief cause in the absence of the right scientific differentiated approach to the use of these substances in order to relieve the deficit in feed protein.

Following the suggestion of VASKHNIL [All-Union Academy of Agricultural Sciences imeni V. I. Lenin], we are conducting a series of experiments on the use of carbamide as a partial substitute of protein in the ration of the ruminant animals. In the experiment, which was conducted during the period from April 1 to May 23, 1958, at the kolkhoz "Po stalinskomy puti", Irkutsk raion,

Irkutsk oblast', the effect of carbamide (in a dose of 1 g per 5 kg of live weight) was tested on the state of health, productivity and nitrogen metabolism of milch cows, while maintaining them on a low-protein basic ration. Three groups of milch cows (of 10 head each) were taken into the experiment; they were of the local Siberian breed, improved by Ostfriesian. The animals were selected on the principle of analogues, taking into consideration the age, productiveness, live weight and the period of lactation. All the cows were expecting their sixth calf, were in the 3-4th month of lactation, first or second months of pregnancy. The animals of the 1st group, on the average, weighed 374 kg, daily milk yield equalled 9.6 L, fat content in milk - 3.85%; in the 2nd group correspondingly - 367 kg, 9.7 L., 3.8%; in the 3rd - 390 kg., 10 L., 3.8%.

The first one was the control group, the two others - experimental. Animals of all groups were given combined feeds, which were, approximately, equivalent in food value, but differed in the source of proteins. The experimental cows received 30% of proteins in the form of nitrogen of carbamide in the combined feed no. 1; in the combined feed no. 2 the basic source of protein was soybean grist. Flour, made from low-grade hay, was used as the basic low-protein component in both feeds. Proportions for the combined feeds are cited in table 1.

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Table 1

Proportions for combined feeds		
Feeds and mineral supplements	Combined feeds	
	no. 1	no. 2.
Granulated oats	10	10.1
Dried waste liquor	20	20
Molasses	3.5	3.5
Soybean grist	-	14.4
Carbamide (urea)*	2.5	-
Wheat bran	20.0	18.0
Hay flour	40.0	30.0
Salt	2	2
Bonemeal	2	2
Cobalt sulfate	3 g per 1 t	3 g per 1 t
Estimated composition in 1 kg:		
Feeding units**	0.53	0.65
Protein	0.24	0.23
Fat	0.03	0.03
Dry substance	0.83	0.83
Calcium (g)	7.7	8.1
Phosphorus (g)	7.6	8.2
Vitamin A (mg)	1	1
Vitamin D (mg)	200	200
Cobalt sulfate (mg)	3	3

*Carbamide was added to the combined feed before feeding the animals.

**In combined feed no. 1 there are less feed units than in combined feed no. 2.

[Begin p.61]

Animals of the first group were supplementally given 3 kg of combined feed no. 2; animals of the second group - 3 kg of combined feed no. 1, and the animals of the 3rd group were also 3 kg of combined feed no. 1, but at the same time carbamide (dissolved in molasses in the amount 89 : 11) was introduced in an equal amount. Molasses were given to all groups in equal amounts (table 2).

Table 2

Rations of experimental animals and amount of feeds consumed by them

Groups	Ration (kg)							Actually consumed (kg)						
	Straw	Corn silage	Combined feed no. 1	Combined feed no. 2.	Molasses	Amount		Straw	Corn silage	Combined feed no. 1	Combined feed no. 2	Molasses	Amount	
						Feed units	Digestible protein (g)						Feed units	Digestible protein (g)
I	8	16.5	-	3	1.1	7.1	844	5.3	16.5	-	3	1.1	6.5	832
II	8	16.5	3	-	1.1	6.7	874	5.4	16.5	3	-	1.1	6.1	863
III	8	16.0	3	-	1.1	6.7	874	5.5	16.0	3	-	1.1	6.1	863

Animals of both experimental groups were given 75 g of carbamide each day during the course of 35 days; this comprised 25% of protein of the entire accepted ration. The animals were trained to take carbamide during the course of 5 days, being given 20 g on the first day, and then 30, 50 and 75 g. The experiment consisted of three periods: during the preliminary (10 days) animals of all groups were maintained on the basic ration with a supplement of 3 kg of combined feed no. 2; whereupon zootechnical clinico-physiological and biochemical indices were taken into account; during the course of the main period (30 days) the full complex of research was carried out, and during the final (10 days) period an exchangeable experiment was conducted, as well as other research, on 8 cows of both experimental groups.

On the 5th day of carbamide feeding in one of the cows of the second group symptoms appeared of a pathological condition similar to uremic toxicosis. After a two-day break in the feeding of carbamide and after the immediate giving of acetic acid, the cow

recovered and was again included into the experiment. There were no other disturbances of the physiological condition of animals (table 3).

Animals of experimental groups did not differ from the control group according to clinico-physiological condition. Milk productivity was estimated for all the experimental cows taking into account each milking. The live weight was determined twice - at the beginning and at the end of the experiment. Data on the productiveness, live weight and percent of fat in milk of experimental cows are cited in table 4. Lactation curves for all the groups are represented in the figure.

Title of figure on page 61: Lactation curve of daily milkings of cows of experimental and control groups.

Words in figure: at the left- milk yield in liters. At the top: 1st group, 2nd group and 3rd group. At the bottom: April-May.

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Table 3

**Clinico-physiological indices of the condition of animals
(average values)**

Periods of research	Groups		
	I	II	III
Before the experiment:			
Temperature	38.2°(37.6-38.6°)	38.2°(38.0-38.5°)	38.1°(37.7-38.6°)
Pulse	61.5(59-66)	63.0(60.0-67.0)	61.3 (59-67)
Respiration	16.1(15-20)	15.8(14-17)	15.5(14-17)
Amount of hemoglobin	58.6(52-64)	59.6(54-68)	62.0(54-69)
In the middle of the experiment:			
Temperature	38.2°(38.0-38.4°)	38.2°(38.1-38.4°)	38.1°(38.0-38.3°)
Pulse	60.8(59-65)	60.2(59-63)	60.9(59-64)
respiration	16.1(13-20)	15.7(15-17)	15.9(15-17)
At the end of the experiment:			
Temperature	38.3°(38.2-38.4°)	38.3°(38.1-38.4°)	38.2°(38.0-38.3°)
Pulse	60.3(59-64)	60.8(60-63)	60.2(60-61)
Respiration	15.8(14-20)	15.9(15-17)	16.1(15-17)
Amount of hemoglobin	53.6(45-63)	55.7(45-65)	55.8(49-66)

Footnote: Qualitative reaction of the urine to protein was negative in all cases

Table 4

Productivity and the live weight of cows (on the average)

Groups	Milking (l)			Fatness of milk (%)		Live weight (kg)		Mean daily increase in weight (g)
	At the beginning of the experiment	At the end of the experiment	On the average during the experiment	At the beginning of the experiment	At the end of the experiment	At the beginning of the experiment	At the end of the experiment	
I	9.6	9.4	9.3	3.80	3.75	374	384	300
II	9.7	9.2	8.9	3.85	3.82	367	373	200
III	10.0	9.3	9.3	3.88	3.73	390	393	100

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Table 5

**Nitrogen metabolism and alkaline reserve in milch cows
in feeding carbamide**

Indices	I group			II group			III group			Mean for two experimental groups		
	Periods*											
	I	II	III	I	II	III	I	II	III	I	II	III
Total nitrogen of the blood (%)	2.9	2.6	2.7	2.9	2.9	2.5	2.1	2.5	2.8	2.5	2.7	2.7
Total nitrogen of the serum (%)	1.2	1.2	1.4	1.3	1.2	1.7	1.3	1.3	1.3	1.3	1.3	1.4
Nonprotein nitrogen of the blood (%)	-	0.3	0.4	-	0.2	0.5	-	0.2	0.3	-	0.2	0.4
Carbamide of the blood (mg %)	57	52	32	62	46	33	61	43	37	61	44	35
Amino nitrogen of the serum (mg %)	53	60	65	67	51	50	58	49	58	62	50	54
Alkaline reserve of the serum CO ₂ (%)	34	52	54	49	48	49	45	49	56	47	49	52
Total nitrogen of the urine (%)	1.0	1.3	-	1.3	1.4	-	1.0	1.2	-	1.1	1.3	-
Carbamide of the urine (%)	2.0	2.5	-	2.5	2.1	-	2.0	1.9	-	2.3	2.0	-

* Periods: I - before the experiment, II - during the middle of the experiment, III - at the end of the experiment

** The morning urine was tested.

[Begin p.63]

The indices of productivity, increase in weight and contents of fat in milk proved to be somewhat lower in animals of experimental groups than in the control. Blood and urine of the experimental cows were tested for contents of the most important nitrogenous substances, which characterize the state of nitrogenous metabolism (table 5).

In animals of all groups changes of indices of nitrogen metabolism and of the alkaline reserve have a similar character, with the exception of the amino nitrogen of the blood serum and the carbamide of the urine, the contents of which somewhat increased during the experiment in animals of the control group, but decreased in the experimental groups. Introduction of carbamide into the ration (in doses adapted by us) did not raise its contents in the blood of milch cows*.

CONCLUSIONS

In substituting carbamide (75 g) for 25% of protein in the daily ration of milch cows, the state of health and productivity of animals proved to be, practically, similar to those in the control group, where cows received an equivalent amount of protein in the form of soybean grist. Feeding carbamide in a dry form with the combined feed, or dissolving it in molasses (89 : 11) and using it for seasoning corn silage, does not make any essential difference. Nevertheless, the most uniform milk production was recorded in cows, which were given carbamide solution in molasses.

According to biochemical indices the nitrogen metabolism of experimental animals differed only slightly from the metabolism of the control group cows. In spite of a single case of clinical

*Discharge of carbamide with the urine, as well as the balance of nitrogen will be ascertained in a special metabolism experiment, the results of which are being processed by us at the present time.

development of toxicosis, a supposition ensues from data of our experiment about the possibility for increasing the dose of carbamide, fed to milk cows under conditions of Irkutsk oblast', up to 1 kg per 4 kg of live weight instead of 1 g per 5 kg of weight. It is suggested that addition of carbamide to the combined feeds and its dissolving in molasses be made at the factories where the combined feeds are produced, where accurate weight dosage can be provided. Combined feeds with carbamide must be put up in special packing with a label and instructions how to feed it.

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Storozhenko, I. U. G.

Ustoichivost' k fitofitore razlichnykh po immun-
nosti sortov kartofelia v usloviakh Sakhalina.

[Resistance to phytophthora shown by various strains
of potatoes with different degrees of immunity in
Sakhalin]

Vestnik Sel'skokhoziaistvennoi Nauki, vol. 4, no. 4,
p.132-134. April 1959 20 V633

(In Russian)

Potatoes are the most important supply crop on Sakhalin. It
comprises 30-35% of all the agricultural crops. Meanwhile the yield-
ing capacity of potatoes on the island, as yet, is low, particularly
owing to extremely strong spreading of the late blight.

Low summer temperatures of the air (in August, the warmest
month, from 16.9 to 17.7°), a high relative humidity of the air
(during the summer months it is rarely below 80%) - all this favors
the spreading of the fungus Phytophthora infestans. Almost every
year a full loss of tops of the non-resistant strains of potatoes
is recorded on Sakhalin; and the loss of tubers from the disease
reaches 40% and more.

At the present time, along with agrotechnical and chemical
methods of control of the late blight, the most essential means
are supposed to be the planting of phytophthora-resistant strains (1).

Candidate of Agricultural Science, Acting Director,
Sakhalinskaia Kompleksnaia Sel'skokhoziaistvennaia Opytnaia Stantsia
[Sakhalin Complex Agricultural Experiment Station]

(2)

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A question about the length of retaining of immunity to the late blight by the potato strains is of great theoretical and practical interest in connection with a swift introduction into production of phytophthora-resistant strains in regions of considerable spreading of this disease.

There are indications in literature about loss of immunity by strains in their long cultivation (2, 3, 5), especially under new conditions that are unnatural to their biology. Thus, in Mexico, in 1952, at the altitude of 2,500 m above sea level, under conditions that were the best for development of the fungus Phytophthora infestans, 134 resistant hybrids were tested, and they all proved to be infected to one or another degree (4). The loss of resistance hampers introduction of phytophthora-resistant strains into production.

We undertook a task both to select, for Sakhalin, high-yielding potato strains, resistant to diseases, as well as to study the length of retention of immunity to late blight by these strains in cultivating them under new conditions, that are favorable to this disease. For this purpose, in 1950, several dozen of phytophthora-resistant strains and hybrids of potatoes were brought to Sakhalin from the All-Union Institute of Plant Industry and the Institute of Potato Industry. The best among them: Ural'skii, Krasnoufimskii, Gibril Kameraza no. 1, Seianets [seedling] 6-103, Seianets 7-585 (All-Union Institute of Plant Industry), Moskovskii and Seianets 998 (Institute of Potato Industry) - were studied during the course of

8 years.

Research was conducted at the Sakhalin Branch of the Academy of Science of USSR, as well as at the Sakhalin Complex Agricultural Experiment Station. In 1950-51, the experimental area of the plot comprised 15,4 sq. m; the control was planted after every four strains. In 1952-53, the experimental area of the plot was raised to 50 sq. m, with a fourfold replication; and later on it was brought up to 100 sq. m with the same replication. Research was conducted on a high agrotechnical base. The non-resistant regionalised strain Berlikhingen, local strains Sakhalinskii 4, Mestnyi alyi and early-ripening strains Pilot and Cobbler were taken for comparison.

The research has shown, that not one of the delivered phytophthora-resistant strains has shown full field resistance to late blight under conditions of Sakhalin. Nevertheless, as a rule, the first symptoms of the disease were found on these strains 15-30 days later than on the non-resistant. Under conditions, especially favorable for the disease, in 1953, the first blemishes of the late blight on Seianets 7-585, 6-103, 998 and strains Moskovskii and Gibril Kameraza no. 1, appeared almost simultaneously with the infection on non-resistant varieties. In 1956, the strains Moskovskii and Gibril Kameraza no. 1 behaved in the same manner. As the observations of many years have shown, the phytophthora-resistant strains permit to move the dates of the appearance of the disease by 2-3 weeks and to reduce the intensity of its spreading.

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Table 1 shows the degree of infection of potato strains with the late blight, varying in their resistance, as it was determined at the end of August and the first ten days of September. In spite of the absence of full immunity, the phytophthora-resistant strains showed very high resistance under field conditions in comparison with the other strains. This was observed also during the years with very strong spreading of late blight (1953, 1957), when there existed very favorable conditions for the development of the disease. Resistant varieties behaved differently in-relation to the fungus Phytophthora infestans, during different years. [Begin p.133]

Table 1

Infection of potato strains, differing in their resistance, with late blight

Strains	1950		1951		1952		1953		1954	1955		1956		1957	
	Aug. 31	Sept. 11	Aug. 23	Sept. 10	Aug. 29	Sept. 12	Aug. 26	Sept. 7	Sept. 13	Aug. 27	Sept. 3	Aug. 27	Sept. 5	Aug. 12	Aug. 29
Ural'skii	0	0	0	0	0	0	0	1	0	0	0	0	0-1	0-1	3-4
Selanets 7-585	0	0	0	0	1-2	4	2-3	4	0	0	0	0	0-1	0	1-2
Krasnoufimskii	0	0	0	0	0	0	0	0-1	0	0	0	0	0	2-3	5
Moskovskii	2	2	1-2	1-2	1	3	3	4-5	0	0	0-1	0-1	0-1	0	2-3
Selanets 6-103	0	1	0	0	0	2-3	3-4	4-5	0	0	0-1	0	0-1	0	3
Gibrid Kamera- za no. 1	1	1	1	1	1	3	4	4	0	0	0-1	0-1	0-1	0-1	2
Selanets 996	0-1	1	1	2	0	3	5	5	0	0	0-1	0	2	0	1-2
Berlikhingen	4	5	3-4	4-5	3-4	5	3-4	5	2	4	4-5	0-1	3-4	2-3	5
Pilot	4	5	4-5	5	5	5	5	5	4-5	5	5	1-2	5	4	5
Sakhalinskii no. 4	4	5	3	5	4-5	5	5	5	3	5	5	1-2	4-5	2-3	5
Cobbler	3	5	4	5	5	5	5	5	4-5	5	5	1-2	4-5	3-4	5
Mestnyi alyi	4	5	3-4	5	4-5	5	5	5	3-4	4-5	5	0-1	3-4	3	5

Footnote: Degree of infection is given according to a six-mark system: 0 - no infection; 1 - up to 20% of the vegetative mass is infected; 2 - up to 40%; 3 - up to 60%; 4 - up to 80% and 5 - up to 100%.

Thus, up to 1957, including also the year 1953, the strains Ural'skii and Krasnoufimskii were the most resistant. Nevertheless, in 1957 both these strains were infected with late blight much stronger than the rest of phytophthora-resistant strains.

It is impossible, on the basis of the conducted research to make a conclusion about any sizable loss of immunity by phytophthora-resistant strains of Leningrad and Moscow selection after their many years cultivation under conditions of Sakhalin. It is interesting, in the this respect to trace the behavior of the phytophthora-resistant Seianets 998. This strain, beginning at the time of its delivery, lost its immunity to the late blight to an ever larger degree. In 1953, it was infected with the disease equally with non-resistant early-ripening strains Pilot and Cobbler; this gave us the reason [Begin p.134] to refer it to strains, which fully lost their immunity. Nevertheless, in later years, it again showed itself as one of the strains that were most resistant to the late blight.

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Table 2 (on page 133)

Yield of potatoes by strains which showed different resistance to late blight under conditions of Sakhalin (c/ha)

Strains	Years:								On an average for 8 years
	1950	1951	1952	1953	1954	1955	1956	1957	
Ural'skii	225	404	432	431	310	354	212	201	321.1
Seianets 7-585	384	541	313	242	316	261	271	201	316.1
Krasnoufimskii	308	302	394	390	252	374	343	134	312.1
Moskovskii	311	431	329	318	213	341	294	246	310.4
Seianets 6-103	418	417	280	212	231	328	230	220	292.0
Gibrid Kameraza no. 1	309	420	270	251	222	333	282	233	290.0
Seianets 998	328	310	296	157	229	295	144	229	248.5
Berlikhingen	222	299	230	249	270	208	240	155	234.1
Pilot	273	315	149	212	131	157	299	162	212.3
Sakhalinskii no. 4	218	300	186	195	192	135	252	135	201.8
Cobbler	250	204	182	267	138	161	242	146	198.8
Mestnyi alyi	192	227	181	174	177	188	209	135	185.4

During our research of many years, the phytophthora-resistant strains of potatoes produced higher yields, under conditions of Sakhalin, than the regionalized and the local strains (table 2). Their yield exceeded the standard by 73.2-34.0%. Besides that the tubers of these strains were of good marketability, had a sufficiently high starch content, were less infected with fungus diseases and kept in storage better.

We came to conclusion, on the basis of our research, that all the phytophthora-resistant strains, which were studied by us, were infected with late blight under conditions of Sakhalin island that are very favorable to the development of the fungus Phytophthora infestans. Although there was no full immunity to late blight in resistant strains, the disease appeared on them, as a rule, 2-3 weeks later and their resistance was very high in com-

parison with other strains. These strains provided also the highest and most stable yields. All this gives a reason for thinking, as before, that the introduction of phytophthora-resistant strains of potatoes into production is the most fundamental measure for overcoming the losses, which are caused by late blight.

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Koordinatsionnoe soveshchanie po Zashchite Lesa

[Coordination Conference on Protection of Forests]

Vestnik Sel'skokhoziaistvennoi Nauki, vol. 4, no. 4.
p. 141-142. April 1959 20 V633

(In Russian)

The traditional methodical Coordination Conference on Protection of Forests from pests and diseases, which was organized by the Committee on the Protection of Forests at the Department of Forestry and Agricultural-Forest-Amelioration of VASKHNIL [All-Union Academy of Agricultural Sciences imeni V. I. Lenin].

It was pointed out at the Conference that there still are large losses from pests and diseases in the forests of our country. In 1954-1956, the Siberian silkworm moth reproduced in great masses on the area about 4 mln. hectares in coniferous forests of Siberia; and valuable wood stands were lost on an area not less than 180 thousand hectares with a stock of wood over 30 mln. cub. m in the reclaimed forests alone. At the present time there exist foci of gypsy moths in the European part of RSFSR on an area of about 2 mln. hectares; this represents a grave danger to forests and fruit plantations. Owing to a badly organized preservation of wood the

Predsedatel' Komissii po Zashchite Lesa pri Otdelenii Lesovodstva i Agrolesomeliioratsii VASKHNIL [Chairman of the Committee on the Protection of Forests at the Department of Forestry and Agricultural-Forest-Amelioration of VASKHNIL]

national economy suffers annually enormous losses, comprising not less than 10 billion rubles per year.

A well adjusted accounting of damage, modern forewarnings about the appearance of pests and forecast of their appearance and propagation for the next year, prove to be the basis without which an effective protection of forests is impossible. The Conference listened, with satisfaction to the report about the organization of a department for forecasting of mass appearance and spreading of pests and diseases in forests at VNIILM [All-Union Scientific-Research (of Institute) Forestry and Amelioration]. Nevertheless, the work of forest pathologists on localities on the control and forecasting of pests and diseases of the forest is not regulated, as yet, by specific instructions from the Union or Republics Ministries of Agriculture, and is conducted from case to case. This situation must be changed immediately. It is necessary to work out a regulation about the work of control and forecasting, which must be followed by the departments of forestry and all the forest farms in their work.

The Conference mentioned a necessity for developing theoretical research and generalization of work, which reveal the causes of the mass propagation of harmful organisms in the forests. Such a distinct knowledge of the rise of foci of mass multiplication will permit to organize correctly the work of forecasting and to improve the methods of control.

At the present time the chief feature of forest protection

is the wide scope of aerial chemical works. It is necessary to improve these works and to introduce into production more effective methods of spraying with mineral-oil emulsions, as well as the fine-drop spraying, to use helicopters, to develop the aerosol method of control; it is necessary to construct midget, light duty machines and good hand apparatuses of a type of Czechoslovak RAG-1. The most important problem of scientific organizations during the next few years is the mechanization of forest protection.

The Conference paid a special attention to the introduction of the achievements of science into production. An opinion was expressed that each scientific-research institute, university and experimental station should patronize one or two forest farms, where they must fully liquidate foci of pests and reduce to the minimum the harm, that is brought to the forests by harmful organisms.

A desirable form for the application to the forestry of attainments in forest protection, is development of systems of forest-protective methods according to zones, and their inclusion into the organizational technical plans in forest management of forest farms.

Systems of control of chief forest pests must be coordinated and conducted in a planned order. One of such systems is the complex of methods for the liquidation of the May-beetle in the forest-steppe and the steppe zones. At the basis of the system lies the chemical method of control of beetles during the time of their supplementary feeding, which should be conducted in a combination with agrotechnical and forestry measures that can be changed in accordance

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with conditions of the place of growing and of the geographical situation of the forest farms. The biological method of control of pests of forestry is only slightly developed in our country. For instance, in Belorussian [Begin p.142] Scientific-Research Institute of Forestry research is conducted during the course of 20 years on the application of egg-eater Telenomus and Trichogrammatidae for the control of pine moth and of other pests of coniferous needles and foliage of trees. Nevertheless, the results of these works are doubtful. Along with this there are data, which permit to consider as effective the microbiological method of control of Siberian silkworm moth and the pine moth, of garden pests, and so on, but this method so far was introduced only slightly.

Up to the present time the scientific organizations for forest protection did not develop a method for evaluation of losses from pests and diseases and evaluation of economic effectiveness of individual measures for the protection of forests.

The Conference mentioned that of late forest phytopathology is behind the requirements of the industry. Effective methods of control of Fores annosus, Dutch disease, "serianka" [gray rot?], vascular oak disease, wilt of maple and of other leafy varieties. It is important to mention that the developed system of measures for the control of lodging of seedlings, of the brown edible mushroom, (Agaricus melleus), and others, are not being introduced into production.

In the coordination of work, of its trend and timely application by the industry, an important role must be played by the Committee for the Protection of forests, which was organized at the Department of Forestry and Agricultural Amelioration.

The Conference pointed out that, in 1958, the research on forest protection was successfully developed at the All-Union and the Ukrainian Institutes for Plant Protection. Data, obtained at these Institutes are of great methodical and practical value. The work is successfully developed at the Leningrad Scientific-Research Institute of Forestry. For instance, a method was developed at the Institute for forecasting the mass appearance of Siberian silkworm moth; the co-workers of the Institute conducted aerial-chemical control of nun moths in forests of the Rumanian People's Republic; research on phytopathology was also conducted. Khar'kov Scientific-Research Institute of Forestry, which is closely connected in the work with forest farms of the eastern part of Ukraine, has developed and introduced into production a system of measures for the control of the leopard moth in the steppe forests and a method of mechanized introduction of Hexachloran dust for the protection of young crops and plantings against larvae of May beetles. In this method, the consumption of dust was reduced to 2-3 kg per 1 hectare. The All-Union Institute of Forestry and Mechanization of Forest Industry has successfully carried out tests of a method of chemical protection of the nonbarked wood.

Important research is conducted at the Moscow Forest-Technical Institute. In 1958, systems of forest protection measures were

developed at the Institute for the State National Forests of the central zone of RSFSR; causes were studied for wilting of pine forests in the Moscow region and methods of application of phosphoro-organic insecticides in forest industry. Besides that, through the Somov expedition of the South-Eastern Trust "Lesproekt" [Forest Project], a system of forest protection measures was applied to the forest management of the "Buzulukskii" pine forest.

Interesting work on studies of mass propagation of gypsy moth in Bashkiria have been carried out by the Bashkir Branch of the Academy of Science of USSR. Actual research of methods of determination of entomoresistant wood species was conducted here.

The Conference examined also the basic problems of control of gypsy moths in central oblast's of RSFSR and adapted specific suggestions for the development of the work of protection of forests in USSR from pests and diseases.

Resources and prospects for the development of
animal industry in Kazakhstan* [Editorial]

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(In Russian).

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The Kazakh SSR occupies one of the first places, among the brotherly united republics, in the production of agricultural products. As a result of reclamation of 20 mln hectares of virgin and waste lands, Kazakhstan became the largest region for the production of commerical grain and occupies a second place after RFSFR. In 1958, kolkhozes and sovkhoses of Kazakhstan sold to the State almost 10 times as much grain, than they annually delivered before the reclamation of virgin and waste lands. As a result of forming, in the regions of virgin and waste lands, of big grain sovkhoses, to which now belongs the chief role in the production of grain, many raions of Kazakhstan, for instance Esil'skii, Ruzaevskii, Irtyshskii, Nurinskii, Oktiabr'skii, and

*To the results of the United Session of VASKHNIL, Kazakh Academy of Agricultural Sciences, Departments of Biological Sciences of the Academy of Science of USSR and of Kazakh SSR, which took place 16-20 March of this year in the city of Alma-Ata with the participation of active members academicians and of corresponding members of VASKHNIL and of Kazakh Academy of Agricultural Sciences, academicians and corresponding members of the Academy of Science of USSR and of Kazakh SSR. Many representatives of scientific-research and experimental institutions of Kazakhstan, Kirghizia, Western Siberia, and others also took part. Members of the Session heard 70 reports at the plenary and sectional conferences, as well as many scientific reports. The Session heard a message of the leaders of branch sections about the accepted decisions and approved an extensive resolution.

others, became the biggest producers of wheat. Over 60 new, virgin soil, sovkhoses sold to the Government, in 1958, over 2 mln puds [pud=36 pounds] of grain each, while all the virgin land sovkhoses - 633 mln puds of grain.

The successes of Kazakhstan in the field of animal industry are considerable also. During the 5 years, which elapsed after the September Plenum of TsK KPSS [Central Committee of the Communist Party of the Soviet Union] (in 1953), the long lagging of the animal industry in the republic has been overcome. During this time the livestock of large cattle increased by 943 thousand head (23%), of sheep and goats by 7.8 mln head (42.3%), and swine by 746 thousand head (by 2.5 times). During this same 5-year period production of meat in the republic (in live weight) increased by 138 thousand tons, milk - by 679 thousand tons, wool - by 21 thousand tons, eggs by 250 mln pieces. Nevertheless, the positive results of development of animal industry are only the beginning of a sharp rise in this important branch of agriculture in the republic.

Comrade D. A. Kunaev, Chairman of the Council of Ministers of Kazakh SSR, said, while opening the United Session, which was dedicated to the problems of increasing the productivity of animal industry in Kazakhstan: "The Seven-Year-Plan, which was developed by our Party, represents a scientifically based program of the further vigorous rise in all branches of national economy, of considerable growth of the economic potential and constant increase of

the living standard of the population. The greatness of the Seven-Year-Plan now delights not only the entire Soviet people, but also the whole progressive humanity".

The 21st Congress of the Communist Party set big and responsible problems before the workers of Kazakhstan. During the current seven years, 119 billion rubles will be invested in the national economy of the republic, or by 20 billion rubles more than during the entire preceding 35 years.

The 21st Congress of KPSS set up a problem of further rise in all branches of agriculture, which will provide the satisfaction of the growing requirements in food and agricultural raw materials. Simultaneously [Begin p.4] with this, the necessity was pointed out for obtaining a maximum amount of production from the unit of area at the smallest expenditure of labor and capital. "As in the years past", said Comrade D. A. Kunaev, "great attention is given to the development of grain farming, in the first place, by the increase of the yielding capacity of the grain crops, especially of wheat - the chief grain crop of Kazakhstan. Kol-khozes and sovkhoses should harvest annually not less than 1.5 billion puds of grain".

The January (16th) Plenum of TsK KPSS [Central Committee of the Communist Party] of Kazakhstan, which discussed the results of the December Plenum of TsK KPSS and the problems of the Communist Party of Kazakhstan, admitted it possible to have at the end of the year 1965 up to 75 mln sheep and goats, up to 7.5 mln head of

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large cattle, up to 2.6 mln of swine, up to 1.8 mln of horses, up to 20 mln head of poultry. At the same time, the 16th Plenum of the TsK KP of Kazakhstan set an aim to bring the production of meat in the republic, already in 1963, to 1251 thousand tons (in slaughtered weight), that is to realize the specified plan not in 7 years, but in 5. It is planned to obtain 9 c of meat in 1963 per 100 ha of agricultural land instead of the 3 c, obtained in 1958. The hard-working men of agriculture in Kazakhstan took upon themselves a socialistic obligation, in 1959, to deliver and sell to the State 800 thousand tons of meat (in live weight) as against 328 thousand tons; that is, over two times more, than in 1958.

The United Session of scientists of four Academies, which examined the most important problems of development of the animal industry in Kazakhstan, has acknowledged that for the realization of all the problems, which were raised by the December Plenum of TsK KPSS, the republic has all the conditions for bringing the livestock of cattle and poultry to the specified quantity at the end of the year 1965 on the basis of further strengthening of the forage base, of specially wide introduction of corn, of the greatest retention of young animals, of liquidation of barrenness of the cows and loss of mature cattle, as well as improvement of feeding, maintenance of animals and their care.

Consequently, the problem is to utilize completely all natural and economic features and possibilities of each oblast', each

raion, kolkhoz and sovkhos for the development, in Kazakhstan, of such branches of animal industry and in such their correlation so as to provide the maximum yield of commodity production.

For the solution of problems of animal industry in the coming seven years the correct evaluation of the economic effectiveness of different branches of farming, including also animal industry is of great importance; the correct working out of such system of objective indicators, which would permit evaluating the branches economically correctly. It becomes possible on the basis of correct economic evaluation of branches of animal industry, to detect the resources for their further development and increase the effectiveness, to determine the most efficient combination of branches. National economy can be efficiently organized only in that case when this or another branch will be economically effective and will answer the requirement of national economy.

Natural conditions of Kazakhstan are exceptionally favorable for development of sheep breeding. Radical changes occurred during the last two years in this branch of animal industry, and this provided a considerable increase in the livestock of sheep (by 7,222 thousand head). There were 26,330 thousand sheep in all categories of farms on January 1st, 1959. Experience of leading kolkhozes and sovkhoses, as well as of many shepherd brigades showed great possibilities, regarding the reproduction of sheep herds and increase of production of mutton and wool. For instance, over 20 shepherd brigades of Chimbkurgansk sovkhos, using harmonal

stimulation of multiparity of sheep ("SZHK"), obtained 135-150 lambs from every hundred mothers and clipped from 2.6 to 2.9 kg of wool (countervail weight) from each Astrakhan sheep. The brigade of the chief shepherd, Dzhangildinov, (Atbasarskii sovkhos, Akmolinsk region) obtained 110 lambs from every hundred mothers and 8.1 kg of wool from each sheep.

The Seven-Year-Plan specified that at the end of 1959 there should be up to 30 mln sheep and goats; among these up to 28 mln head at kolkhozes and sovkhoses; and at the end of 1965 up to 75 mln head. In connection with this, it is supposed to obtain from the 11,865 thousand mothers, available in 1959, the same number of lambs as against the 9,400 thousand of lambs, which were actually obtained in 1958.

It is contemplated that the plan for the production of mutton be realized in the course of five years. It is planned to produce 250 thousand t of mutton (in live weight) in 1959. It is considered, in connection with this, taking off about 5 mln sheep from among those putting on flesh.

As practice has shown, kolkhozes and sovkhoses of Kazakhstan can successfully carry out the planned assignments on the increase of sheep livestock, production of mutton and wool, by mobilizing the resources. According to data of the Ministry of Agriculture of Kazakh SSR, during the fall of 1958, at the season of mating and of artificial insemination, the mothers were in a good state of fatness. This permits [Begin p.5] to assume that in 1959

kolkhozes and sovkhoses will obtain a higher commercial yield of lambs. By means of correct organization of the spring mating of Karakul sheep, whose lambs will be slaughtered for Karakul furs in the early spring, it will be possible in the fall to obtain a second lambing of lambs. This method of increasing the livestock of sheep received a wide spreading in sovkhoses of the South-Kazakh oblast'. The reduction of inside-the-farm slaughtering of sheep can produce a vast economy, as well as a sharp reduction of losses of sheep from various diseases. All this will require great organizational and zootechnical work both on the part of specialists, as well as of scientific workers.

In pre-revolutionary Kazakhstan, under conditions of nomadic and semi-nomadic economy, the process of breed formation of sheep was directed basically to the improvement of Kazakh fat-tailed sheep, which were well adopted to breeding in deserts or semi-deserts and which were characterized by a good meat-fat productivity, high early-maturing and excellent capacity for fattening. Along with this, the fine-wooled sheep breeding was developed very slightly in Kazakhstan before the revolution.

During the Soviet period, and especially in the last several years in Kazakhstan in north-eastern and south-eastern oblast's the fine-wooled wool-meat and meat-wool line received a wide development.

In accordance with the problem of bringing the livestock of sheep and goats up to 75 mln head in 1965, it is considered necessary

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to develop five basic lines of sheep breeding in the republic:
1) fine-wooled wool-meat, 2) fine-wooled meat-wool, 3) semi-fine-wooled meat-wool, 4) meat-fat fat-tailed, 5) Karakul fur. Depending on zonal peculiarities and on the range of requirements on the production of sheep breeding, its corresponding lines will be represented by different breeds and intrabreed types of sheep. At the end of 1965 in the republic as a whole the following specific numbers are expected in the basic lines: fine-wooled and semi-fine-wooled - 59%, meat-fat fat-tailed - 23% and Karakul (fur) - 18%.

Sheep breeding is developed relatively lightly in Central Kazakhstan, an area of 100 mln ha, with extremely varied, basically severe, natural climatic conditions. It is considered, during the next seven years, sharply to increase here the numbers of sheep and allocate them, according to zones and lines as follows: in the steppe and dry-steppe zones the fine-wooled, in the semi-desert the semi-fine-wooled and the meat-fat; and in the desert the meat-fat line. As a result of further development of meat-fat and meat-wool sheep breeding in kolkhozes and sovkhoses, with a simultaneous qualitative improvement of the herd by highly productive breeds, Central Kazakhstan will become an important base in the republic for the production of mutton, of the coarse, semi-course and semi-fine-wooled wool and of sheepskin fur raw materials.

In accordance with the projected plan for the next seven years, the Session recommended further improvement of the existing, and breeding of new breeds and breed groups of sheep that will be characterized by high productivity and, first of all, by fleshiness: Kazakh fine-wooled and Kazakh Arkharomerino, meat-wool semi-fine-wooled, early maturing meat-wool (Hempshire X Kazakh) groups of fine-wooled sheep in Pavlodarsk oblast, and in the south of the republic also Degeressk, Kargalinsk and Edil'baevsk breeds and breed groups.

In regions, that are set aside for meat-fat sheep breeding, it is recommended widening the measures for crossing the unimproved fat-tailed herds with Edil'baevsk, Kargalinsk and Saradzhinsk sheep; this will permit to increase the production of mutton and of rug wool. It is recognized as expedient in Kazakhstan to organize pedigree sovkhoses for the work with the following breeds and breed group: meat-wool semi-fine-wooled, the early maturing meat-wool, Tsigaisk, Degeressk, Saradzhinsk and Kargalinsk.

It is recommended to the scientific-research institutions of the republic to conduct the work in sheep breeding, according to peculiarities of different economic zones, in the direction of increasing meat productivity of the fine-wooled sheep of the wool-meat line, without reducing their basic wool productivity and improving the quality of wool in every way. It is recommended to organize in raions of Central Kazakhstan semi-fine-wooled sheep breeding, and early maturing meat-wool fine-wooled sheep breeding

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in northern raions of the first zone of Kazakhstan.

It is intended, as the next problem, considerably to increase the number ["udel'nyi ves"] of females, especially, in meat-wool fine-wooled and semi-fine-wooled lines, as well as in meat-fat sheep breeding.

Further research on the regularities of growth and development of sheep, and working out of methods of raising their fertility, early maturing, better remuneration of feed by meat production, as well as studies of quantitative and qualitative changes of meat productivity of sheep, depending on the organization and [Begin p.6] technique of rearing and the age of slaughtered sheep, permit considerable raising of the economic effectiveness of sheep breeding in kolkhozes and sovkhoses of Kazakhstan.

Cattle breeding is an important source for production of beef and milk - the second leading branch of animal industry in the republic. At the present time, in Kazakhstan, 54 head of large cattle fall for each 100 head of the population, or by 15 head more than on the average in USSR. High rates in the increase of large cattle and in the production of beef were established in the republic during the last two years. These rates can be retained for the following period also.

Beef cattle industry, with which 255 sovkhoses and kolkhozes of 47 raions are occupied, is one of the most important and large resources of meat production in the republic. On January 1, 1959, in Kazakhstan, in the zone of beef animal industry, there were

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1,406 thousand head of large cattle; this comprised 44.3% of the total livestock of this type of cattle in the republic. It is supposed widening considerably in the future the zone of the beef cattle industry. In this zone, during the next 3-4 years the basic mass of large cattle livestock must be represented by high-blood crossbreeds of the Kazakh whitehead and the Kalmuck breeds, as well as by breeds Santa-Gertrudis and some other local breeds.

During the years of Soviet rule, and, especially, after the collectivization of agriculture, this branch underwent great qualitative changes. A large body of pedigreed cattle (about 70%) was produced in the republic; it was concentrated, basically, in kolkhozes and sovkhoses. Breeding of two new breeds of large cattle in the republic played a large role in the pedigree transformation; namely, of the "Alatau'skaia" (by means of crossing local cattle with the "Shvitskii" [Swiss] in the south-eastern mountain-foot hill zone) and the Kazakh whiteheaded (by means of crossing local cattle with Hereford in the dry-steppe and the semi-desert zones). In this same zone local cattle is bred; it is improved by crossing with the "Astrakhanskii".

As a result of crossing local cattle with "Krasnostepnyi" [Red steppe] and Simmental, large bodies of crossbreeds were produced in northern, north-eastern and north-western Kazakhstan. In the presence in the republic of: 31% of cattle of Kazakh white-headed breed and its crossbreeds, 27% of the red steppe breed, 14% of "Alatau'skaia", 14% of Simmental, 4% of "Astrakhanskia", and 3%

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of the "Aulieatinskaiia", a problem is faced increasing still more the numbers of pedigreed cattle in the republic. This will permit increasing beef and milk productivity of cattle still more in the future. In connection with this, large cattle of many valuable milk-beef breeds will be imported to Kazakhstan during the current Seven-Year-Plan.

Further specialization in animal industry will proceed still further in proportion to the increase of livestock of large cattle of beef and milk breeds. In this respect the important role belongs to the councils, formed in Kazakhstan, on the work with Kazakh whiteheaded breed, with "Alatau'skaiia", and "Aulieatinskaiia", as well as to the zonal council on the work with the red steppe breed. Organization, in Kazakhstan, of a network of State Stations for breeding work and artificial insemination will permit elevating the breeding work with large cattle to a higher standard.

The United Scientific Session thought it necessary to recommend to scientific-research establishments of Kazakhstan to work out appropriate forms of combination of beef cattle husbandry with milk and other branches of animal industry in all the regions of Kazakhstan. The Session recommended organizing in Kazakhstan special farms for breeding work, in order to develop specialized beef cattle breeding and organize mass growing of pedigreed livestock, especially, bulls-producers.

A method of industrial crossing will be worked out in order to obtain early maturing young beef cattle. The United Scientific

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Session also recognized it necessary to recommend the organization of intensive milk cattle breeding around large cities and industrial centers. Heavy-duty and light mechanization must be introduced to the kolkhoz milk farms and sovkhoses, as well as conditions must be produced for self-service and self-feeding of animals.

It is also anticipated to solve great problems in swine husbandry in Kazakhstan: at the end of 1965 the numbers of swine in the republic must be increased up to 2.6 mln head, and the production of pork by the end of 1963 must rise to 355 thousand t. Kolkhoses and sovkhoses attained certain success in the last few years in this branch; nevertheless the farms did not exhaust the existing possibilities.

According to the estimates of the Ministry of Agriculture of Kazakh SSR, it is possible to obtain from mothers, existing on January 1, 1959, during the course of the year not less than 2.2 mln of suckling pigs and to fatten about 1,700 thousand swine, providing the production of pork at a rate of 132 thousand t (in live weight) as against 37 thousand t in 1958. The livestock of swine must increase up to 1,100 thousand head by the end of 1959.

The Session set before scientific-research establishments of Kazakhstan [Begin p.7] a problem for developing a system for conducting swine husbandry, taking into account natural economic conditions and peculiarities of agriculture in different zones of the republic; to produce a good breeding base for raising planned breeds of swine; to study and recommend to the industry effective

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methods of intrabreed industrial crossings and obtaining intralinear crossbreeds in crossing inbred lines for the maximum utilization of heterosis.

Poultry raising is an important source for obtaining cheap nourishing meat under conditions of Kazakhstan. This branch receives an ever increasing spreading in animal industry of Kazakhstan. It is sufficient to say, that in 1958 alone the livestock of poultry increased by 48%. In 1958, the incubator-poultry raising stations (IPS) sold to kolkhozes and sovkhoses 10,365 thousand head of young birds. At the beginning of the current year there were 3,682 thousand mature birds at the kolkhozes and sovkhoses of the republic. During the current years kolkhozes must accept from the IPS, as well as from their own incubators, not less than 42 mln chickens and fatten not less than 27 mln head of poultry.

At the present time there are, in the republic, not less than 500 thousand head of waterfowl. In the presence, in the republic, of an immense number of water reservoirs it is fully possible to grow hundreds of thousands of ducklings on these water reservoirs, utilizing the natural forage at its maximum. According to estimates of the Ministry of Agriculture of Kazakh SSR, during the current year the kolkhozes and sovkhoses of the republic can fatten and deliver to the State not less than 15,000 t of meat of waterfowls. Effective methods of raising chickens by the nest-camp method, as well as over a deep bedding, especially in mass raising

of poultry for meat, are of great importance under conditions of Kazakh SSR. Development, by the scientific institutions of Kazakhstan, of efficient systems for raising chickens for meat, the so-called broilers, will permit considerably to increase the production of bird meat during the course of the year with the smallest expenditures of labor and capital.

Kazakhstan can also become a large base for production of eggs and egg output. In connection with this, the Session recommended to the scientific-research institutions of the republic to concentrate the attention on the formation of a breeding base, on the raising of the egg-laying capacity of birds, especially, of meat-egg breeds. In this respect, the works on commercial crossing and hybridization of animals, on the basis of development of inbred lines, and crossing with the aim of utilizing heterosis in poultry raising will be of great importance.

The United Session, taking into consideration the latest scientific data, as well as the leading experience of kolkhozes and sovkhoses, considered it expedient to begin the development of systems of conducting various branches of poultry raising according to natural zones of Kazakhstan. Formation of breeding bases will greatly assist in the raising of meat qualities and in the egg-laying ability of hens. An important condition for increasing the production of poultry meat is the development of poultry raising around large cities and industrial centers.

Horse breeding and camel breeding must have further development during the current Seven-Year-Plan. The problem is raised, in 1959, to increase the livestock of horses in kolkhozes and sovkhozes up to 871 thousand head, and by the end of 1965 on the whole for the republic up to 1,800 thousand head. At this time the production of horse meat must also grow to 85-90 thousand t as against the 47 thousand t in 1958.

The Session considered it necessary to draw the attention of scientific institutions of Kazakhstan to the development of methods of raising and improvement of productive qualities of horses and camels as applicable to different zones of Kazakhstan. Along with this the breeding work with planned breeds must be improved, as well as the work on development of specialized meat and milk types of horses.

The Session raised before scientific institutions of Kazakhstan several practical tasks and scientific problems, in accordance with assignments for the Seven-Year-Plan. Scientific methods for intensification of reproductive functions of animals should be developed for carrying out the chief problem concerning the increase of livestock of agricultural animals and of meat productivity by the animal industry; methods and technique of artificial insemination, applicable to different kinds of agricultural animals; zootechnical and veterinary measures on questions of raising of all the young agricultural animals, which come into being and the retaining of the female body of the herd.

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The Session considered necessary, as one of the immediate tasks, in 1959, for scientific-research establishments of Kazakhstan, to render scientific help on efficient organization to agricultural agencies, concerned with putting on flesh and fattening of the entire meat contingent of large cattle, sheep, goats and horses, as applicable to natural and production conditions of various zones of Kazakhstan.

The Session recommended, concerning the increasing of productivity of animal husbandry, to continue development of pure-bred breeding of agricultural [Begin p.8] animals, to develop methods for creating constitutionally different productive and stud types within the breed, as well as to improve the breeding, according to lines and families, in order to create a breeding base of animals, valuable in hereditary qualities, and, first of all, of producers.

Effective procedures must be developed for using various methods of crossing in order mainly to increase meat and other kinds of productivity of animals in commercial herds; it will be expedient to develop methods for drawing up plans of breeding work with a breed, as a whole, on instances of work with individual breeds of large cattle and sheep. Testing of producers on the quality of their descendants will be organized at Stations on Breeding Work and Artificial Insemination, as well as in all breeding herds. Serious attention should be given to development

of scientifically based methods of evaluation for provision of farms with fodder, taking into consideration its value; to problems of effective use of feed resources by means of inclusion into feeding rations of various stimulants, trace elements, antibiotics and others. The problem-thematic plan, recommended by the Session, provides for wide studies of the quality of animal husbandry production (of meat, wool, and others) in developing methods of efficient feeding, selection, and others; studies of the most efficient veterinary-zoohygienic conditions of maintenance and utilization of agricultural animals, in conformity with characteristics of natural zones of Kazakhstan.

The United Scientific Session pointed out in its resolution that, at the present time, the attention of scientific institutions and of all the scientists of Kazakhstan, who work in the field of agriculture, must be focused on such scientific problems, the successful solving of which will help a quick increase of the livestock of cattle in the republic and the growth of the production of animal industry products, with the smallest expenditures of labor and capital per unit of production. Scientists must furnish to the industry such advice, the introduction of which will provide increase of labor productivity, increase in the yield of animal industry production per 100 hectares of agricultural lands with a simultaneous reduction of its cost.

The Session mentioned that the reduction of labor expenditure and of the cost of animal industry's production will be helped by

further specialization of breeds and of the intrabreed types, by the wide use in animal industry, of complexes of machines and of special outfitting for the electromechanization of animal industry farms. Especial attention, in this respect, must be given to the mechanization of the water supply, the milking of cows and shearing of sheep, preparation of combined feeds, removal of silage from trenches and its distribution to the animals.

Accomplishment of these tasks depends to a great degree on the condition of the fodder base in kolkhozes and sovkhozes. Kazakhstan is a republic of unbounded steppe spaciousness which is very favorable for successful development of sheep breeding, animal industry, swine husbandry, horse breeding and poultry raising.

In the territory, equalling 275,800 sq. km, 9.2 mln. ha (3.4%) fall to the lot of natural hayfields, 165.8 mln ha (60.1%) to natural pastures. Although the productiveness of natural forage lands is comparatively small (from 8 to 50 c of hay per hectare)*, nevertheless, it is possible to obtain yearly from the existing area, on the average not less than 70 mln t. of feed (in conversion to hay). The lacking need in green pasture forage and hay can be made up by means of increasing the yielding capacity of hayfields

*All over the whole republic 3.45 c of fodder (in conversion to hay from one hectare) are obtained, on the average, from natural and forage lands: in mountainous regions - 5 c, in forest-steppe and steppe - 4.5, in the semi-desert - 3.55 and in the desert 2.1 c. It is possible to obtain 14 times more feeds, than at the present time, from the entire area of forage lands with the planting of fodder crops

and pastures. It will be necessary, for this purpose, to accomplish a great complex of measures on the superficial, as well as radical, improvement of natural hayfields. The practice of kolkhozes and sovkhoses of Kazakhstan showed a high effectiveness of additional sowing of perennial grasses (crested wheat grass, alfalfa, esparsette), as well as of annual crops (winter rye, oats, barley and others), of rejuvenation of couch grass - sedge pastures and hayfields by periodical plowing. A considerable increase of yield of grasses is obtained from introduction of organic, mineral and bacterial fertilizers to the mountain, estuary and water meadows, that are we¹¹ moistened.

Estuary irrigation, particularly a system of multi-storey estuaries, formation of steppe estuaries of shallow filling and of oasis irrigation, under conditions of Kazakhstan, are recognized as very effective measures that increase the productivity of pastures. The practice of many kolkhozes of sovkhoses of Kazakhstan has shown that, on the average, 200-300 rubles per 1 hectare of the estuary are required for the estuary irrigation, for instance for the construction of directing and water-retaining [Begin p.9] embankments and water drains. With a yield of 20 c of hay per hectare the outlay for estuary irrigation is repaid in the course of 3-4 years. Kolkhoz "Imeni Voroshilova", Novorossiiskii raion, Aktiubinsk oblast', obtained with estuary irrigation, on the average, about 17 c of hay per hectare on the area of 1,000 ha, and on the nonirrigated hayfields only 4.5 c. At the Karagandinsk Experimental Station from 45.3 to 67.8 c of hay per 1 ha were obtained with

with the estuary irrigation, while on nonirrigated sections of hayfields - from 5.6 to 9.2 c of hay per 1 ha. Under conditions of Kazakhstan the estuary irrigation represents a big resource for a sharp improvement of the forage base. According to approximate estimates, it will be possible, in the near future, in Kazakhstan to carry out estuary irrigation on an area of 3.5-4 mln ha.

According to estimates, made by the Pasturing Committee of SOPS [Council for study of Productive Resources] of the Academy of Science of USSR, it will be possible in the next few years, by means of radical improvement, to put into agricultural circulation (it is meant to plant perennial grasses as well as some grain crops), not less than 35 mln. ha, or 20% of the entire area of natural forage lands in the republic; among them 10.44 mln ha in the forest-steppe and steppe, 18.61 mln. ha in the semi-desert, 1.16 mln. ha in the desert, 5.24 mln. ha in mountain regions*. From the total area of 35 mln ha, suitable for agricultural reclamation, about 5 mln. ha can be introduced into the field crop rotations; these are, basically, chernozem or chestnut soils, or soils with a small part of solonetz [dark strongly alkaline soil]. Over 30 mln. ha - mainly complexes and compositions of zonal soils and soils of hollows and gullies with a considerable amount of solo-

*Formation of planted hayfields is of special importance for the desert and the desert-steppe zone, situated in the south-east and south of the republic, where over 60% of all the pasturing territory are situated and in the fall-winter period a vast livestock of cattle of kolkhozes and sovkhoses is concentrated. In Alma-Ata and Taldy-Kurgan oblast's, in 1958, about 100 thousand ha were allotted to planted hayfields; this permitted to form considerable, assured stocks of hay.

netz - can be utilized under plantings of perennial grasses or can be diverted to grass crop rotations with one or two fields of grain or annual fodder crops.

In modern animal industry, field fodder production, in the system of field or fodder crop rotations, is an inalienable part of the forage base. Its proportion and structure, under conditions of Kazakhstan depend on many different soil-climatic conditions of individual raions of the republic, on the kind of the raised cattle and of the production trend of animal industry in kolkhozes and sovkhoses.

In 1957, 4157.7 thousand ha were taken in Kazakhstan under cultivated feed crops, among these 753 thousand ha under silage (among these under corn 614.2 thousand ha) and 159.7 thousand ha under annual grasses. During the current Seven-Year-Plan the role of field forage production will grow still more considerably. Corn has shown itself as an exclusively valuable crop in the strengthening of the forage base in Kazakhstan. Leading kolkhozes and sovkhoses in the steppe and dry-steppe zones and in eastern oblast's of the republic, utilizing the scientifically tested complex of agrotechnical measures, obtained 300-350 c of green mass of corn on dry lands, and in southern and south-eastern oblast's on irrigated lands - up to 700-800 c per hectare.

The United Session considered it necessary to recommend to kolkhozes and sovkhoses a great complex of measures on the expansion of planting areas and raising of corn production. It was, parti-

cularly, recommended to plant on each farm both the medium-ripening and the late-ripening varieties in order to obtain high yields of corn ears of milk-wax ripeness. The highest yields of corn, at smallest expenditures of labor, are ensured by planting it on fertile sections of irrigated lands and estuaries by the checkrow method and obtaining two-three plants per hill. Considerable increase of the yield of green mass and of corn ears is ensured by good care of plantings; particularly by pre-sprouting and after-germination cultivation of the soil - rolling, harrowing, application of organic and mineral fertilizers, and on irrigated lands and on the semi-provided dry lands the planting of trigonella for green fertilizer.

Kolkhozes and sovkhoses will, in every way possible, strengthen the forage base in conformity with the planned tasks on development of animal husbandry and increase its productivity. Along with superficial improvement and efficient utilization of the existing natural forage lands** each farm will [Begin p.10] develop forage production, particularly, sowing of grasses on field sections, which are not included in field or forage crop rotations.

**General attaching is meant of hayfields and pastures to kolkhozes and sovkhoses; also introduction into practice of pasture and mowing rotations, the so-called "corralled" (cage, portion, small areas) utilization of natural planted hayfields in order to raise their capacity and to reduce losses of grass yields, owing to their trampling down.

In connection with this, the Session recognized it necessary to recommend for wide application the experience of raising the productivity of pastures and hayfields, that are situated on solonetz and solonetz complexes, by means of terrace. ["Iarusnoi"] plowing of soil and a following planting of perennial grasses, since this method has been tested under conditions of Stalingrad, Saratov, North-Kazakhstan and Western-Kazakhstan oblast's. Along with this, the Session considered it expedient, in the near future, to start building hydrotechnical installations and, first of all, for the estuary irrigation of the most valuable hayfields and pastures.

According to data of experimental institutions, under conditions of Kazakhstan (in northern raions), the planting of perennial grasses in double or tripe alfalfa-grain and esparsette-grain mixtures are the most expedient. It was acknowledged necessary, beginning with the year 1959, to use spring harrowing (in 2-3 "sleds" [tracks?]) on the entire area of perennial grass plantings, with the exception of subcover crop plantings of grasses during the first year of use.

It is possible to obtain in the southern raions of Kazakhstan high yields of alfalfa on irrigated lands, with improved agrotechnique, and crested wheat and esparsette besides that on dry lands. In droughty regions of the republic the field forage production must develop through widening of planting areas of sorghum and Sudan grass. The Session recommended, for increasing the harvest

of plant protein, to widen the planting areas of chick-pea, vetchling, peas, soybeans and certain other cereal-legume crops, and in northern, sufficiently humid, raions in the irrigated zone - of vetch and vetch-oats mixture.

In meadow-pasture crop rotations it is most expedient to assign the annual and perennial grasses to pasturing and hay, as well as the grain-forage crops, while in crop rotations, situated near farmsteads, the labor consuming and hard to transport crops-- corn for silage, green and succulent forage, as well as potatoes for fodder and fodder melon patch crops.

The Session recommended to scientific-research institutions of Kazakhstan for development during the current Seven-Year-Plan a large complex of scientific problems on increasing the corn production; on raising the productiveness and efficient utilization of natural forage lands; on the boosting of protein production, on cultivation of new and improvement of the existing varieties of grasses and organization of their seed growing; on improving the technology of provision of fodder, mechanization of forage production, and others.

In the presence of a large machine-tractor fleet, the kolkhozes and sovkhozes of Kazakhstan have all the possibilities for wide mechanization of forage production; first of all in cultivating corn, as well as in conducting hay harvesting. This will permit obtaining, annually, high and stable yields of grasses and different forage crops in amounts which will ensure full require-

ment of the growing animal industry in valuable fodder.

The Session recommended conducting a series of specific measures for the improvement of water economy constructions for irrigation and water supply for pastures, as well as estuary irrigation in the republic.

Mentioning considerable successes, as well as shortcomings, in the work of the scientific institutions of Kazakhstan on the working out of problems of biology of agricultural animals, the Session has outlined also some specific measures in this direction. Having approved the suggestions of the Kazakh Academy of Agricultural Sciences on problems of economics and organization of animal industry, the Session outlined basic measures in this field; carrying out of this will hasten solving the problem of a sharp rise in production of the output of animal industry in the republic.

Speaking at the United Scientific Session, Chairman of the Council of Ministers of Kazakh SSR, Comrade D. A. Kunaev, said that the scientists of Kazakhstan made a valuable contribution to the development of agriculture in the republic. They assisted, by their research and valuable suggestions, in the growth of yielding capacity of agricultural crops, in the increase of livestock of cattle and in the raising of the cattle's productiveness. Along with this there are great shortcomings in the work of scientific research institutions of the republic, which hinder the progress of agricultural science and further development of the kolkhoz and sovkhos production.

Individual scientific-research institutes and experimental stations work without coordination, duplicate subjects of scientific research; often give advice to agricultural industry, which is economically ungrounded. He said further that it is necessary, on the basis of fundamental criticism and self-criticism, to find the causes, which hinder the development of science and agriculture, and evaluate correctly the immediate tasks of the scientific-research institutions for every kind of help to kolkhozes and sovkhoses in the accomplishment and overfulfillment of the Seven-Year-Plan for the development of agricultural production in Kazakhstan.

Starosel'skii, Ia. Iu.

Primenenie menialushchikhsia kontsentratsii pri izuchenii novykh preparatov (metod logarifmicheskogo opryskivaniia)

[Method of changing concentrations in the study of new preparations (method of logarithmic spraying)]

Vestnik Sel'skokhoziaistvennoi Nauki, vol. 4, no. 5, p.110-113. May 1959 20 V633

(In Russian)

In evaluating the effectiveness of application of new preparations for the control of weeds, one has, as a rule, to resort to their comparison with the already known herbicides. Frequently one dose, chosen for comparison is quite insufficient, and it is necessary to test several doses. Nevertheless, when their number is great, then the results are not precise owing to the cumbersomeness of the layout of the experiment. Evaluation of effectiveness of the compared preparations is very approximate to a certain degree, since the most comparable data can be obtained only in comparing preparations in doses which produce a similar effect, but not in comparing different effects of similar doses. But with a limited amount of studied doses (2-3) they can be compared only by resorting to interpolation.

Nauchnyi Institut po Udobreniiam i Insektofungitsidam imeni Professora Ia. V. Samoilova [Scientific Institute of Fertilizers and Insectofungicides "Imeni" Professor Ia. V. Samoilov]

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A much fuller characteristic of preparations, under comparison, can be obtained while using them in a full series of gradually increasing doses. A similar method was suggested by P. G. Shitt for studying areas of plant nutrition. Success in realizing the of doses was attained in utilizing changing gradual changing concentrations, the so-called logarithmic spraying; R. Gregory reported about this at the First East-African Conference on Herbicides. Logarithmic spraying is based on the principle of gradual reduction of herbicide doses as the sprayer moves along the field, owing to dilution of the initial solution of the herbicide. Thus, the passed course is the logarithmic expression of concentration of the herbicide solution.

A certain concentration corresponds to each section of the field, and, in order to determine the concentration, it is sufficient to know the distance of the section from the beginning of the field. The obtained results permit comparing the tested preparations by means of comparison of curves of their effectiveness as a whole and of individual points, that are characterized by the same effect. Method of logarithmic spraying opens up great possibilities for a more detailed evaluation of new preparations in respect to their comparative effectiveness. It is very convenient for the rating of the selective effect of preparations, since, depending on the doses, it permits characterizing their degree of toxicity more accurately for weeds and for cultivated plants. This method opens wide possibilities in testing herbicide mixtures, which are receiving wide distribution abroad.

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In field experiments, in 1957, we conducted logarithmic spraying with herbicides* with the aid of two knapsack sprayers of the type "Avtomaks", mounted on a cart. One sprayer was filled with water, the other with the solution. The sprayers were connected by a hose so that as one became emptied the liquid from the other flowed into it, thus, gradually reducing the initial concentration of the solution.

The general area of the fields was 100 sq. m, the experimental areas of the elementary fields in fractional calculation of variants with changing concentrations - 7.5 sq. m; fourfold replication of experiments. The speed of movement of the sprayer - 20 m per minute. Expenditure of liquid - 1,000 l per 1 ha. Each field was treated with one passage of the sprayer, the speed of movement [Begin p.111] of which was checked by a stop-watch. Uniformity of distribution of the preparation along the entire width of the field (3.5 m) was provided by 10 sprayers, situated in pairs at a distance of 70 cm and having 5 pipe-lines of similar length so that at each moment all the sprayers would throw out the solution of one and the same concentration.

At a uniform speed of movement of the sprayer and constant per second expenditure of liquid, the amount of the introduced

* Further on we intentionally use a more general term "spraying with changing concentrations" instead of the term "logarithmic spraying", inasmuch as the logarithmic curve of reduction of concentrations is not precise for us and it is necessary to strive for its greatest correction.

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herbicide must drop rectilinearly from the beginning to the end of the fields. In the construction, used by us, the pressure was formed in the reservoir only during its loading, and was not upheld further on; therefore, with the drop of the level of liquid, the pressure in reservoirs was reduced approximately by 25%, since the sprayers were filled only $\frac{1}{4}$ full; as a result of this the per second outlay of liquid was reduced also. Distribution of the dose of working substance from the beginning to the end of the field occurred according to a curve presented in the diagram (figure 1). In treatment by the usual method the sprayer with water was disconnected.

Title of figure 1. Distribution of doses in spraying with changing concentrations.

Words in figure 1. At the top: doses (kg/ha). At the bottom: Elementary fields. Experimental length of the field. General length of the field.

Rating of the density of the stand of oats and of weeds was conducted on experimental "metrovka" [square meter plot]; two square meter plots in the usual spraying and 9 on the field with changing concentrations of the solution. The height of plants was determined by measuring 10 stalks situated along the diagonal line of the experimental square meter plot. Yield of the total mass was calculated at harvesting, while the yield of grain from each field was determined from two test sheaves, which were dried to an air-dry condition. On fields with changing concentrations the

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harvest was calculated fractionally (according to elementary fields) and then underwent the threshing.

A field experiment was laid out in oats plantings in order to study the herbicidal characteristics of the anti-grassy weed preparation ammonium trichloroacetate (TKHA-a") [TCA-a] and to compare it with the already approved preparation of the same type - sodium trichloroacetate ("TKH-n") [TCA-s]. Utilization of a cultivated plant in the experiment guaranteed a greater accuracy of data, owing to the fact that the experimental plants were evenly distributed on the section and were similarly developed. Although this method has its shortcomings, it, nevertheless, gives good results in studies of the comparative effectiveness of the preparations. TCA can both be introduced into the soil, as well as used for spraying the above ground mass.

In the given experiment, the effectiveness of TCA-s and TCA-a were studied in spraying the plantings during the period of full tillering of oats (June 20). The method of changing concentrations was compared with the usual spraying. In changing concentrations, the spraying was begun with a dose of 50 kg per 1 ha and was gradually reduced to 0. In variants with the usual spraying TCA was introduced in the dose of 16 kg of the working solution per 1 ha. On the next day after spraying, as a result of the effect of TCA, yellowing of the tops of leaves was noted. In the usual spraying of plantings it was impossible to ascertain by sight the difference in effectiveness of the action of the preparations. About half of

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the plants were damaged, and the remaining ones somewhat lagged in growth. No substantial differences in the action of TCA-s and TCA-a were noticed either right after spraying, or later on (table 1).

Table 1

Effect of sodium trichloroacetate and ammonium trichloroacetate on oats after the usual spraying (one month after treatment)

Variants of the experiment	Number of plants per 1 sq. m	Average height of plants (cm)
Control	240	69
TCA-s	118	58
TCA-a	115	57

On fields, treated with changing concentrations, owing to the fact that the initial dose was considerably higher than the usual, oat plants were affected at the beginning of the field very strongly, while towards the end the injury was lessened. On fields treated with TCA-a the plants grew brown and dried up to a greater distance from the beginning of the field than in the variant with TCA-s.

In table 2 results are cited of estimates of undamaged stalks of oats, which were conducted on 9 experimental square meter plots, situated along the length of the field [Begin p.112] at a distance of 2 m from each other (figure 1). Such a spacing of the experimental square meter plots corresponded to doses of TCA in the limits from 4 to 50 kg per 1 ha. (table 2).

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Table 2

Effect of sodium trichloroacetate and of ammonium trichloroacetate on oats in treatment with changing concentrations

Doses (kg/ha)	Number of undamaged oat stalks per 1 sq. m		Height of undamaged oat stalks, (cm)	
	TCA-s	TCA-a	TCA-s	TCA-a
4.0	174	172	68	71
8.0	162	153	63	62
12.5	142	127	58	56
17.5	151	119	58	54
23.0	130	135	57	52
29.0	118	115	53	49
35.5	121	100	55	45
42.5	120	105	51	45
50.0	76	72	47	43

Data, cited in table 2, show considerable growing of the effect with the increase of doses of herbicides; whereupon, in all cases, the effect of TCA-a appeared stronger than TCA-s.

Graphic representation of these data (figure 2) in the form of straight lines deprived of deviations, permits determining by how many times TCA-a was more toxic than TCA-s. Connecting both straight lines by a horizontal line, it is possible to determine by the crossing points the doses of both preparations, which produce a similar effect.

Title of figure 2. Effect of the growing doses of ammonium trichloroacetate and of sodium trichloroacetate on the impairment of oat stalks

Words in figure 2. Starting at the top left: Healthy stalks per 1 m². TCA-sodium. TCA-ammonium. At the bottom: Doses (kg/ha)

In order to reduce the density of the oats stand to 125 healthy stalks per 1 sq. m, 31 kg of sodium TCA per 1 ha were required in our experiment. This same effect was attained by introduction of 22 kg of ammonium TCA. In the given case the latter acted stronger by 20% than the first. Similar results were obtained also in the determination of the height of oat stalks. As a result of treatment of plantings with TCA, there were less of healthy oat stalks, and, besides that, lagging was noted in their growth. With the increase of TCA dose the height of plants decreased regularly from 71 to 43 cm. In treatment with ammonium TCA, the height of plants to 55 cm 33 kg of TCA-sodium were required to be introduced. In treatment with TCA-ammonium only 19.5 kg per 1 ha were required (figure 3).

Title of figure 3. Effect of increasing doses of ammonium trichloroacetate and sodium trichloroacetate on the height of oat plants.

Words in figure 3. At the top: Height, cm.
TCA-ammonium. TCA-sodium. At the bottom:
Doses (kg/ha).

In this case the ammonium salt of TCA proved to be more effective by 41%, than sodium salt. The cited data permitted to ascertain a stronger toxicity of TCA-a, which in the experiment proved to be more effective than TCA-s by 30-40%. Use of the method of spraying with changing concentrations permitted determining more accurately the difference of the effect of the preparations and to express them quantitatively.

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Crops from sections, treated with changing concentrations, were harvested on August 23, and on the next day from section treated in the usual manner. Results of yield estimates are cited in table 3.

As it is seen from table 3, the treatment of oat plantings with TCA by the usual method produced a negative effect on the yield of grain and straw, having reduced it almost by 2 times; whereupon TCA-a produced a somewhat stronger effect than TCA-s. Treatment of plantings with changing concentrations of TCA produced still stronger changes in the oats harvest, which decreased regularly with the increase of doses. The advantage [Begin p.13] of TCA-a was noted in variants with all doses (figure 4).

Table 3

Effect of sodium trichloroacetate and ammonium trichloroacetate on the yield of oats (c/ha)		
Variants of the experiment	Yield of	
	Grain	Straw
Control	16.3	15.3
TCA-s	10.2	10.9
TCA-a	8.8	8.8

Title of figure 4. Effect of growing concentrations of ammonium trichloroacetate and sodium trichloroacetate and sodium trichloroacetate on the yield of oats.

Words in figure 4. At the top; kg per field. TCA-ammonium. TCA-sodium. At the bottom; Doses (kg/ha).

A similar effect was produced by a $1/3$ lower dose of ammonium TCA than sodium TCA. Thus, in order to reduce the harvest on the field at 0.7 kg (medium effect) there were required 26 kg of TCA-a per ha, while in using TCA-s for the attaining of the same effect - 39 kg of the preparation.

Similar results were obtained in comparing the effectiveness of various esters of 2,4-D. In the usual, field method, when each ester was used in only two doses, differences between them were not as great and definite so as, on this basis, to give a preference to one of them. But in comparing these same esters by a method of changing concentrations, when their effect on plants was traced in doses from 0 to 2 kg per 1 ha, it was established, with a sufficient definiteness, that octyl ester 2,4-D was more effective in treatment of grain crops than butyl ester 2,4-D. Having a similar toxicity for the weeds, it harms the cultivated plants less in increased doses, therefore it can be used in higher doses (by 25%).

On the basis of data of our experiments, in the workshop of NIUIF [Scientific Research Institute of Fertilizers and Insecto-fungicides imeni Ia. V. Samoilov], in 1958, a power-driven "logarithmic" sprayer was produced, which gave good results in testing new herbicides.

The described method of spraying with changing concentrations is very convenient for the initial field evaluation of new preparations. By means of improvement and its wider utilization

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under production conditions, it is possible to characterize more fully the studied preparations and make better plans for further field tests of these preparations.

Bolsunovskaya, O. V.

Plenum Gosudarstvennoi Komissii po Sortoispytaniu
Sel'skokhoziaistvennykh Kul'tur

[Plenum of the State Commission on Variety Tests
of Agricultural Crops]

Vestnik Sel'skokhoziaistvennoi Nauki, vol. 4,
no. 5, p.140-141. May 1959 20 V633

(In Russian)

A Plenum of the State Commission on Variety Tests of Agricultural Crops at the Ministry of Agriculture of USSR took place in Moscow, on February 19 to 21, of the current year. Inspectors of the State Commission, workers of the MSKH [Ministry of Agriculture] of USSR, of RSFSR and of scientific-research institutions took part in the Plenum. A series of important questions was discussed at the Plenum and appropriate resolutions on them were adapted.

Inspectors of the State Commission of United Republics, Comrades I. S. Lovchikov, M. S. Shalaev, E. D. Eginson, I. M. Ognev, P. K. Galitsinskii, V. S. Dzhanelidze, T. A. Topchibashev, V. A. Shilinis, A. T. Delimarskii, A. S. Meleshkin, A. L. Sotnikov, I. F. Nenakhov, Ts. A. Torosian, B. B. Gusson and A. F. Raud addressed the meeting with reports about changes in the operative variety regionalizing and about the work on State testing. The speakers told about peculiarities of work on variety testing in connection with problems, which were raised by the 21st Congress of the Communist Party, as well as depending on conditions in the re-

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publics. It was emphasized in all reports that [Begin p.141] special attention is paid, in regionalizing the varieties, to their qualitative evaluation in order that industry obtain new highly productive and high quality varieties. The newly regionalized variety of winter wheat "Bezostala I" (selection of the Krasnodar Institute of Agriculture) in Crimea oblast' and Krasnodar krai answer these requirements, as also do the variety of peas "Smolenskii 812, regionalized in Smolensk oblast', potato variety "Detskoi'skii" (selection of the All-Union Institute of Plant Industry), which was regionalized in Leningrad oblast', and others.

According to the report of the Chief of the Section of Methods and Agrotechnique of the State Commission, Doctor of Agricultural Sciences, Iu. N. Malygin, a resolution was adapted about the need of introduction of supplements and changes into the method of State variety testing of agricultural crops. Instead of the existing system of variety testing on small and large plots and in the industrial testing, beginning with the year 1959 only competitive and industrial variety tests will be conducted. For certain, chiefly, labor consuming crops and "mnogosborovym" [difficult to harvest?] the minimum size of plots in competitive testing is established as 50 sq. m, retaining the 4 to 6-fold replication. Industrial tests (with direct supervision of workers of the Variety Test Plot) will be conducted, first of all, at that kolkhoz or sovkhoz, where the variety plot is or at a farm nearest to it. In the absence of the possibility to lay out the experiment on

these farms, they can be conducted also on other farms under the leadership and observation of agriculturists of these farms.

Changes were introduced also in special methods for crops, mainly for corn, olive family, silage, vegetable and melon patch crops, potatoes, grasses, and others.

Beginning with 1959, a mathematical treatment of yield data of competitive tests is being introduced with the use of methods of variation statistics. Introduction of this method gives a possibility of determining the authenticity of data on the yielding capacity of tested varieties, in comparison with standard regionalized varieties and the accuracy of experiments on the variety test plots.

In the current year an organization is foreseen at the State Variety Test Plots for testing expanded collections of varieties. All the varieties, which undergo competitive variety testing in this zone, as well as valuable varieties from other zones, will be included in the tests. Besides that, into these collections will be included those varieties from other zones, which must be examined for the resistance to one or another characteristic (winter hardiness, lodging and others), the evaluation of which is impossible or very difficult to conduct in their own zone, owing to the peculiarities of meteorological conditions (absence of bleak winters, of a sufficient amount of rain). Here too will be tested all the local varieties, varieties which were developed by plant breeders, who conduct experiments outside the scientific-re-

search institutions, as well as varieties of foreign origin.

K. N. Godunova, Candidate of Agricultural Sciences, gave an account, in her report, of the new problems of the State Commission on testing on variety test plots not only the varieties, but also the effectiveness of new agrotechnical measures. Organization of this work is of special importance, since the introduction into agricultural industry of progressive agrotechnical methods plays a deciding role in the raising of the yielding capacity of agricultural crops.

Chief of the Department of Fruit-Berry Crops of the State Commission, Candidate of Agricultural Sciences V. V. Lebedev, gave an account of problems of fruit-berry and grape variety test plots, in connection with the resolutions of the 21st Congress of the Communist Party. Along with he told about the work on the organization of variety test plots, about development of methods of variety testing of fruit-berry crops, and others.

The Plenum considered 295 suggestions about the inclusion into State testing of new varieties of agricultural crops and species of bombyx of Soviet selection. A decision was made for testing 229 varieties, included among these are 11 varieties of spring wheat, 11 of corn, 15 of cotton, 21 of potatoes, 3 species of bombyx, and others. Besides this, 90 varieties of foreign selection were included in the testing. The Plenum made a decision on excluding from testing 412 unpromising varieties of agricultural crops and species of bombyx.

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Chief of Department of the State Commission, V. S. Gurchenko, presented a report on changes in the network of State Variety Test Sections.

The Plenum considered the problem of awarding the authorship for development of new varieties. One hundred fifty five applications were examined for 97 varieties, whereupon the authorship was assigned to 106 plant breeders; included in these were such varieties as winter wheat "Lutetsens 230", spring wheat "Pshenichno-pyreinyi gibrid 56", [wheat-wheatgrass hybrid], sugar beet "Belotserkovskaya odnosemiannaya" [single-seeded], tomatoes - "Skorospelyi Volzhskii 288" [early ripening, Volga].

Lively debates developed about the reports that were heard; members of the State Commission; inspectors and specialists of the State Commission, as well as specialists of scientific-research institutions, took part in them.

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vg/M

Zhukovskii, P. M.

Vzaimootnosheniia mezhdru khoziaimom i gribnym
parazitom na ikh rodine i vne ee (K ucheniiu
ob iskhodnom materiale dlia selektsii)

[Interrelation between host and fungal parasite
in their place of origin and beyond it (To the
studies of initial material for selection)]

Vestnik Sel'skokhoziaistvennoi Nauki, vol. 4, no. 6,
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(In Russian)

Research in the field of immunity of plants to infectious diseases is, mainly, of fragmentary nature. As before, certain aspects of immunity are treated in this research, but the problem, as a whole, remains just as difficult, although its urgency grows from year to year. Both theory and practice lag. Many articles are published about morphological, histological and histochemical factors of immunity; about the effect of mineral and organic fertilizers, particularly trace elements, effect of time of planting of cultivated plants and many other agrotechnical methods for the increase of resistance to diseases. The theory of immunogenesis of plants, suggested by M. S. Dunin, is well-known. In the near future the theory of D. D. Verderevskii will be published about phytoncidal origin of immunity to parasitic diseases.

Professor; Active Member - Academician of VASKHNIL [All-Union Academy of Agricultural Sciences imeni V. I. Lenin]

In spite of doubtless value of all these publications, practically, they can be but slightly used in selection and genetics.

Genotypic immunity in geographical connection, as we introduce it in the present article, is of the greatest importance. This will serve as one of the divisions of the science of initial botanical-geographical material for selection.

Unfortunately, the work on studies of immunity of agricultural plants is organized unsatisfactorily in our native agricultural science. The parasite, its races, cycles of development in various geographical zones is not sufficiently studied comparably with the ontogenesis of the host. Physiological races of the parasite and individual biotypes, and, the more so, their genesis, are almost not studied at all, while the methods of study of races are not sufficiently reasoned out. The races are but those strains which display a different character of reaction to certain pure-line varieties of the host. Artificial inoculation is used little; this is inadmissible, since natural infection does not take place annually. Besides that, the regime of successful inoculation is not yet ascertained for many plants. It was established that growing potato seedlings at high temperatures and insufficient access of oxygen cause the infection of seedlings by those races of *Phytophthora*, which do not affect them under normal conditions. In the dry climate of Central Asia, at a comparative low humidity of air, even in regions of artificial irrigation, epiphytotics of leaf and stem rusts are almost unknown among plantings of wheat.

[Begin p.26]. Study of cycles of the parasite often proceeds according to a false course, since the initial loci of infection of the host sometimes remain unnoticed by the observer, if he examines its morphogenesis insufficiently attentively. Often plant breeders check their new variety on the resistance to rust on an unfertile infectious background, forgetting, or not knowing, that the rust fungi infect the perfectly healthy, well-fed, but not the weak plants.

The basic feature for planning the selection work for immunity is the knowledge of prevalent physiological races and their distribution in the given geographical region. It was demonstrated that races of stem rust of wheat and crown rust of oats, even those collected from various countries, show long stability in respect to their reaction on the host. It was proven that new virulent races of the fungus arise by means of hybridization and mutations. It is possible to obtain new aggressive races of the stem rust of wheat in artificially crossing its heterozygous races.

There exists a genotypical resistance to diseases. Many wild relatives of cultivated plants possess it. It was formed historically at the place of origin of the host and the parasite. N. I. Vavilov was the first to express this idea. Now we have many facts and we can say, that, if the species of angiospermous plants did not have high resistance or even immunity in their place of origin and of the parasite, they would have died. Owing to genotypic immunity of many wild relatives of cultivated plants, even their

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hybrids, provided the selection of parental pairs was fortunate, are characterized by such a high resistance that they at times rescue big sections of the plant industry on the terrestrial globe; it was thus, for instance, with the cultivation of sugar cane in Indonesia, with coffee cultivation on Ceylon; and now only the development of hybrids of cultivated potatoes with wild immune species from the section of Tuberosum can save the potato industry on the terrestrial globe, including also USSR, from constant epiphytotics of Phytophthora, canker, pathogenic viruses and other diseases.

Wild relatives of cultivated plants usually do not possess absolute immunity at the place of origin of the parasite; this can be considered as a regularity. They possess the so-called "field resistance" (field resistant, Feldresistenz), or tolerance. The fungal parasite, as a rule, infects only certain parts of the plant, producing a limited sporulation and necroses. This permits such relatives for thousands of years to survive as hosts in the parasite's place of origin, and the parasite to survive as a constant pathogen of infection. In those geographical regions where the place of origin of both the parasite and of the host coincide, there takes place a parallel evolution of the host, which produces new, more resistant varieties and forms, and a parallel evolution and adaptation of the parasite, that produces new, more virulent races (the so-called aggressive races).

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Let us demonstrate this on the example of three plants: wheat, oats and potatoes.

The place of origin of wheat is Caucasus and the central and eastern provinces of Asia Minor, Syria, Palestine, as well as western provinces of Iran, adjoining it. This was proved by a large number of endemic varieties of wild and cultivated wheat. It is only in this foremost Asiatic focus on the terrestrial globe that this species potential of genera Triticum, Aegilops and Secale is concentrated. It is exactly here that were formed the diploid, tetraploid and hexaploid orders of Triticum L. Wild diploid species of einkorn - Triticum aegilopoides and Tr. thaudar, which occupy considerable areas, are widely spread in the region of mountainous steppes of Asia Minor. Tr. aegilopoides can also be met in Syria, Palestine, Georgia, and on the Balkan peninsula. Many endemic species of wild and cultivated wheat were described as occurring in Caucasus, [Begin p.27] although some of them prove to be synonyms. L. L. Dekaprevich described such endemic species for Georgia as hexaploid Tr. macha, tetraploid Tr. palaeo colchicum, Triticum georgicum, Tr. tubalicum. M. G. Tumanian described for Armenia diploid Tr. urarti, and Makushenko described Tr. armenicum. M. M. Iakubtsiner described for Armenia the endemic hexaploid species Tr. vavilovi. P. M. Zhukovskii described for Caucasus ancient species, endemic in culture Tr. timopheevi and Tr. persicum (now, Tr. carthlicum). The French geneticist, Dr. H. Heslot, described for Iran a new endemic primitively-cultivated tetraploid

species, which he called Tr. ispahanicum. The German geneticist, Dr. H. Kuckuck, has discovered in Iran, on one of the hills in the Bakhtiari oblast', the center of which is the city Shahr Kord [Chigha Khur] a section of ancient cultivation of the spelt (Tr. spelta), which corresponded to the European spelt in its morphological and anatomical data. Yet in 1923, in Persian Kurdistan, around the lake Urmia, I have discovered sections of plantings of spelt (its type is preserved in Leningrad at the Herbarium of wheats of VIR [All-Union Institute of Plant Industry]); it was classified by us, at that time, as a speltoid of the soft wheat, but which, nevertheless, proved to be a genuine spelt. Tr. durum, Tr. aestivum, Tr. turgidum, Tr. compactum, and even in some places Tr. turanicum are cultivated in Transcaucasia in great diversity; whereupon these species here are very differentiated. It is true, such tetraploid cultivated species of wheat as Tr. durum, Tr. turgidum, Tr. polonicum and Tr. dicoccum originated and differentiated in Ethiopia and the Mediterranean countries of North Africa.

Species of genus Aegilops are widely distributed in Caucasus and in adjoining countries of Asia Minor and of the Near and Middle East. Some of them took part in the origin of cultivated wheats. It is now acknowledged that the soft wheat (Tr. aestivum) contains in its karyotype genomes of Tr. monococcum, Aegilops squarrosa and, apparently, Aeg. speltoides, "aspe'l'ta" (Tr. spelta) - genomes of two first partners. This confirms the origin of hexaploid wheats in countries of the Near and Middle East (Tr. aestivum, Tr. spelta)

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and Transcaucasia (Tr. macha, Tr. vavilovi).

The aggregate of the cited data permits considering, with full certainty, that the process of species formation of wheats in the described botanical-geographical part of the terrestrial globe came about during many millenia (archeological research has confirmed it).

Along with this, the Caucasus is the main and, apparently, primary focus of development of the leaf (Puccinia triticina) and stem (P. graminis tritici) rusts.

During the course of millenia occurred a divergent form-development of wheats and a parallel form-development of virulent races of rusts, which was accompanied by an adaptation to the host, that is to various species and forms of wheat. Polymorphism of wheat could not proceed in the absence of parasites. Where species of wheat originated and differentiated, there too sprang up various races (strains) of rust. The Caucasus, and the countries adjoining it, being the place of origin of diploid, tetraploid and hexaploid wheats, became also the birthplace of the leaf and stem rusts of wheat. It is natural, therefore, that Caucasus and Asia Minor became the strongest infectious background, where species of wheat developed that were the most resistant to leaf and stem rusts in the world: Tr. aestivoides, Tr. monococcum, Tr. timopheevi, Tr. persicum (now Tr. carthlicum). The amphidiploid Tr. fungicidum, developed through artificial crossbreeding of Tr. timopheevi and Tr. persicum, is also characterized by this high resistance.

But although the most resistant species of the host originate in the place of origin of both the host and the parasite, they, nevertheless, probably do not possess an absolute immunity. [Begin p.28] This is confirmed both when studying wheat as well as oats and potatoes. Without possessing absolute immunity, as an ideal manifestation of resistance, they have "field resistance" and tolerance, which permit them to survive in the place of origin of the parasite during the course of thousands of years. Yet, in 1923-1924, we recorded for Georgia a considerable susceptibility to powdery mildew (Erysiphe graminis) of certain forms of Triticum persicum (Tr. carthlicum) and partly to leaf rust in Georgia. M. M. Iakubtsiner confirmed this for Azerbaijan and Dagestan. In Georgia we had to deal with infected plants of Tr. monococcum. M. M. Iakubtsiner observed individual plants of Tr. timopheevi, that were infected with stem rust in Western Georgia, that is in the birth-place of this species of wheat. The hard wheats (Tr. durum), which have a reputation of being resistant to rust species and were collected from various countries of the globe: Balkan peninsula, Indostan, China, Asia Minor, Jordan, Egypt, Algiers, Cyrus, Sicily, Spain, Greece, Czechoslovakia, South Africa, USA, USSR (Ukraine, Kirgizia) and others, and which were planted in Dagestan (Derbentsk base of VIR), were infected to 3-4 points (according to a 5-point system) except for the Caucasian and Balkan forms, which were infected to 2 points. All soft wheats (Tr. aestivum) from different countries were infected still stronger.

The German Institute of Plant Industry sent us, in 1957, 19 samples of seeds of various hybrids of wheat, resistant to leaf rust (Puccinia triticina). Not one of these hybrids, including the variety indicator, was less infected than to 4 points (according to the 5-point system) when planted in Caucasus (Kuban and Maikop Experimental Stations of VIR). The celebrated varieties "Kenya" (744, 745 and others), which are resistant to all races of rusts in Australia, New Zealand and to the 30 prevailing races in Canada, proved to be susceptible to leaf and stem rusts and to powdery mildew in North Caucasus. More than that, the wheat variety Novoukrainka 84, which was selected especially for resistance to leaf rust in North Caucasus proper was infected there and in Dagestan with leaf rust to 3 points; varieties Skorospelka 3 and Bezostala 4, which were developed of late for the same purpose in Krasnodar krai, were infected in North Caucasus to 2 points. The 42-chromosome fractions of hybrids Tr. fungicidum X Tr. sphaerococcum were infected in Dagestan to 1-2 points, possessing tolerance but not full resistance.

There is no doubt that in Caucasus we find the place of origin of the leaf (Pucc. triticina) and stem (Pucc. graminis tritici) rusts of wheat, the species, which since olden times were connected with species of diploid and tetraploid wheats. It is natural that in the place of origin of Triticum L., during the course of many millenia, appeared also the specialized parasites of this kind with many aboriginal physiological races, which are virulent even

to Tr. monococcum, Tr. timopheevi, Tr. carthlicum. It is possible that the extreme susceptibility of hexaploid wheats (including Tr. aestivum) can be explained by the presence in them of two genomes of the genus Aegilops (Aeg. squarrosa and Aeg. speltoides). Origin of genome "G" in the most resistant tetraploid species Tr. timopheevi remains unknown. At the present time we possess a polyploid order Tr. timopheevi. Besides the tetraploid Tr. timopheevi ($2n=28$), known to all, hexaploid forms ($2n=42$) were also established in its natural population in its place of origin (in Western Georgia); these were isolated by V. L. Menabde into an independent species Tr. zhukovskii Men et Eriz. as well as the octoploid form ($2n=56$), which was artificially obtained in France by Dr. Heslot; whereupon octoploidy was connected with the mutation of coloring (a black spike). This octoploid form the author earmarked as species Tr. timonovum Heslot. Thus, Tr. timopheevi Zhuk. gets into the range of a super-species or conspecies. We cite [Begin p.29] this fact in order to point out a continuing evolution of the very old species Tr. timopheevi and the increase of susceptibility to leaf rust partly in hexaploid, but especially in octoploid form of Tr. timopheevi.

According to the plan for this article, we must be interested in what happens after importing the host or parasite separately, or both together, to other, far removed, geographical regions of the globe. It is known that in North America the local wild species of grapes are resistant to Plasmopara viticola (mildew) the place of origin of which is there also. These species possess a genotypic

immunity to this parasite of the class of Phycomycetes. When after the discovery of Columbus, the best varieties of excellent European grapes were imported to North America, they, at once, started perishing there from this disease. On the other hand, Plasmopara viticola was brought to Europe with the cuttings of American species, that were resistant to phylloxera. Discovery of the Bordeaux mixture in France by Milliarde saved the European viniculture, but up to the present time mildew still remains as a dangerous disease in the Old World. An especially striking example is the intrusion of potato late blight (Phytophthora infestans) to Europe from North America. The fungus from the same class of Phycomycetes was brought in 1830, and 16 years later, outside the place of origin of the fungus, sprang up the devastating epiphytotic of Phytophthora in Ireland, where potatoes became the basic food plant. One million people died in Ireland owing to the famine, while 1.5 mln migrated to other countries. Something similar occurred, in 1949, in Chile. The reason was that there did not exist any crop of Solanum tuberosum in the place of origin of Phytophthora in Mexico and it infected there wild tuberiferous species of potatoes. In the Old World the cultivated potato S. tuberosum was already widely distributed in the middle of 19th century. Having reached Europe, Phytophthora found a very susceptible host outside its place of origin, and since that time the Old World stands before a problem of control of this most dangerous parasite. The geographical factor here was of deciding importance. Solanum tuberosum never possessed a genotypical immunity to any of the races of Phytophthora.

An intensified selection activity in Europe on developing new varieties of potatoes is hampered greatly now by the appearance of new local aggressive races of Phytophthora. When comparatively recently S. tuberosum was begun to be cultivated also in Mexico (instead of S. anadigenum and others), in the place of origin of Phytophthora, all the numerous Mexican races of Phytophthora "attacked" the new-comer, from the temperate zone of Chile; a country that did not know Phytophthora up to 1949.

The cited data show the importance of secondary foci of development of the parasite, that spring up outside its place of origin. Argentina has a reputation in USSR as a country of wheats that are immune to different species of rust, of flaxes immune to fusarium wilt, and others. Indeed, such Argentine varieties as Magnif MB, Klein petise, La Prevision, Klein Ceres, Klein H-66, Klein Cometa, Klein Amalia Klein, and others, stand out sharply by their resistance to leaf and stem rusts in North Caucasus and in Dagestan, that is in the place of origin of these parasites. But in Argentina proper they do become infected with certain races. Apparently not only these geographical races of rust, but vicarious races as well are absent in Caucasus. A great number of physiological races of stem and leaf rusts exist in Argentina. There they differentiate Puccinia triticina and P. rubigovera tritici as species of the leaf rust. One should point out, that in Argentina, owing to Dr. Jose Vallega, the talented specialist on immunity of plants, the work on studies and mapping out of physiological races of rust is organized excellently. [Begin p.30].

Both the wheat and its rust were brought in to Argentina from the Old World after the middle of 16th century, probably, by sea. It is possible, nevertheless, that the stem rust, from which Argentina is suffering, and, perhaps, the leaf rust also were native. In the light of work of Guyot, in France, the stem rust of wheat (Puccinia graminis tritici) infects many genera of cereals; they are native to Argentina also. When wheat got into Argentina, the local races of stem rust adapted themselves to it easily.

Rust uredospores are carried a long way by air also. Craigie showed the existence of "spore showers" of uredospores. It was noted in North America that the southern wind brought rust uredospores from a distance of over 1,000 km and distributed them over an area of more than 0.5 mln sq. km. There were so many of them that on a single acre, which was slightly "seeded" with uredospores there were 10 trillions of them, and on a heavily "seeded" - many times more. In USSR a case is known of the "spore shower" of uredospores in Stalingrad oblast, which has formed an island of infection in a vast area of uncontaminated fields of wheat. Probably intercontinental drifts of uredospores are possible through the air.

In the case of absence of intermediate hosts for stem rust (species Berberis, Mahonia) and therefore, a dropping out of the phases of spermogonia and aecidia, the epiphytotics are only possible owing to the overwintering of uredospores; but then it is not

known, how will that reflect on the emergence of aggressive races. However, there are many barberries, meadow-rue (Thalictrum) and other hosts of rust in America.

In any case, the emergence in Argentina of the secondary focus of form-development of wheat rust is indisputable. Composition of races in the primary (Caucasus and the adjoining oblast's) and in the secondary geographical foci is entirely different. This fact introduces a geographical correction in the genotypic immunity of species.

Genotypic immunity of the host is formed historically in the place of origin of the parasite, and there, although it is not absolute, it is fully reliable for the purpose of selection. Outside the place of origin, the resistance of the host depends greatly on the virulence of local geographical races of the parasite.

Let us analyze the evolutionary interlinked species Avena sterilis (wild) and Av. byzantina (cultivated). The first species is widespread in Palestine (Israel). Its local name "common oats" points to its widespreadness. Here, in its birth place, it is infected with crown and stem rusts, whereupon their races are identical to those which were removed from the cultivated genus.

In spite of susceptibility to infection, the forms of wild oats Avena sterilis do not suffer and show exceptional resistance (tolerance) to both species of rust (Puccinia coronifera and P. graminis-ovenae). The life cycle of crown rust is ensured in Palestine, owing to the presence of Rhamnus alaternus and R. palest-

tinus. It was established that race 270 of crown rust originated endemically in aecidia of local buckthorn. Many Palestinian races of crown and stem rust are highly virulent, but a series of varieties of cultivated Av. byzantina, originating from Av. sterilis, is resistant to them. The most virulent race 6 of stem rust of oats comprises 97% of all races and was collected from 14 genera of cereals.

Dr. Wahl points out that oats Av. sterilis and Av. byzantina sprang from one geographical area. Evolutionary development of the host and the parasite, their mutual adaptation here too prove to be interconnected. [Begin p.31]

A prolonged struggle for survival between the host and parasite, produces an adequate resistance of the host to races of rust of high virulence.

In the selection of potatoes for resistance to diseases, the most essential is the resistance to Phytophthora and to virus diseases. It was pointed out previously that potato blight was a historical disaster. In USA, in the state of Wisconsin, at the collection nursery of wild potato species, of interspecific hybrids and cultivated varieties, many thousands of clones are studied for their resistance to blight; as a result of this many clones were isolated that are resistant under local geographical conditions. Intensive work on development of blight resistant varieties is conducted in the German Democratic Republic, in Western Germany, in Holland, Sweden, England, USSR, Australia

and others. Each country developed varieties that are resistant under local geographical conditions. But this is almost an illusion. In the place of origin of Phytophthora in Mexico practically almost any of these varieties from the Old World and USA, which were put out for sale as blight resistant, come to grief (J. Niederhauser).

In Mexico, our common potato (S. tuberosum) is a new crop. Its yields are small. January plantings (early), during which the cycles of the host (potato) and of the parasite (late blight) do not coincide, produce healthy potatoes, but the plants are developing during a dry period. Artificial irrigation raises the cost of the crop extremely.

May plantings at the beginning of the rain period could be giving high yields, but they are infected with blight, since during this period favorable weather conditions are formed for its development. Spraying with fungicides raises the costs too much. The way out of this situation is development of blight-resistant varieties. Under such conditions, ever since old times, a struggle against blight proceeds here in the hexaploid wild species of Solanum demissum and the diploid wild species. At the present time here was established a great number of physiological races of Phytophthora, to which many tens of varieties of S. demissum are resistant. But there do not exist absolutely immune varieties of S. demissum. There are forms outstanding in their "field resistance" or tolerance. Blight infects only the lower leaves, and it does not spread further: sporulation is limited. there are

clearly expressed necroses (Niederhauser). This permits surviving of S. demissum in Mexico for millenia against such a dangerous infectious background. Thus, on the example with potatoes, we see that in the place of origin of host and parasite occur their parallel form-developments and parallel, reciprocal adaptation.

Against the same several infectious background in Mexico, since olden times, exist such diploid tuberiferous wild species of potatoes as S. bulbocastanum, S. pinnatisectum, S. cardyophyllum, S. polyadenium, and others, which are considered even more resistant to blight than, S. demissum. S. bulbocastanum has been studied already quite well (Graham, Niederhauser and Servin). It was found out, that this species, in general, is extremely self-sterile and is composed of cross-sterile and cross-fertile plants. After inoculation of 1148 seedlings of S. bulbocastanum with races 1, 2, 3 and 4 of Phytophthora infestans three types of infection were observed: a) considerable resistance with small necroses on lower leaves, b) resistance with imperceptible sporulation of the parasite and c) susceptibility, expressed by large sporulating injury. Seedlings, possessing resistance to Mexican races of blight are not always resistant to Guatemala races, and vice versa. Both diploid and triploid forms are met in populations of S. bulbocastanum. [Begin p.32].

Genotypic immunity of the host is formed historically in the place of origin of the parasite, but it is not absolute and is expressed in the form of field resistance and tolerance. In the crucible of many centuries of struggle of the host and parasite,

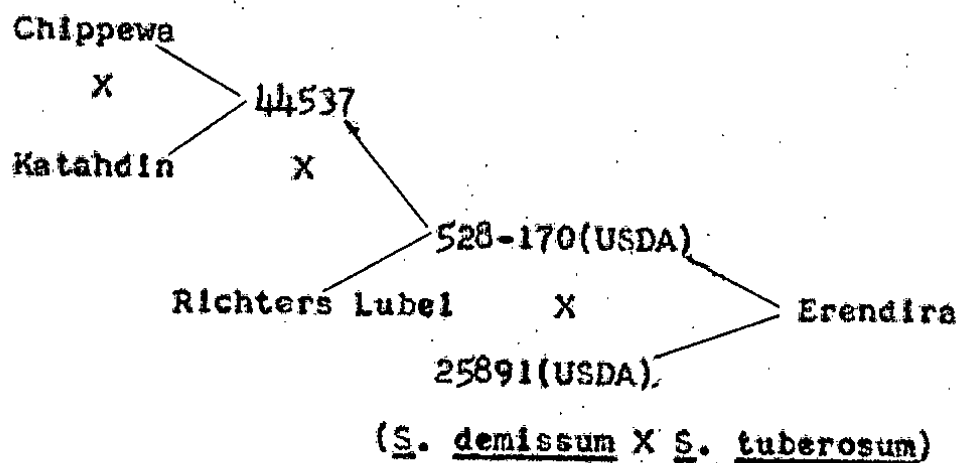
both partners evolve and both survive. The botanist, who is occupied in introducing the plants, the geneticist and the plant breeder must have a world map of geographical localizations of genotypes, resistant to diseases, superimposed on geographical foci of origin of parasites, connected with them. It is useless to look for resistance to blight in many wild tuberiferous species and in cultivated local varieties of potatoes (S. tuberosum) in South America; that is, away from the place of origin of the parasite, historically localized in Mexico and Guatemala.

Resistance to root-knot eel-worm (Heterodera rostochiensis) is geographically centered in high-mountainous regions of north-western Argentina. Its carrier is the wild large-tuber diploid species Solanum verneyi. The tetraploid cultivated species S. andigenum (H. Brüscher), which sprang from it, contains nematode-resistant forms in its range.

It is useless to look for genotypic immunity or strong tolerance of wheats to leaf rust beyond the place of their origin in Caucasus, in Iran and Asia Minor. Only in the case of development of a strong secondary geographical focus of form-development of the parasite, producing its isolated geographical races (Argentina) it is possible to find there races tolerant for the primary focus.

Tolerant genotypes undoubtedly transfer this characteristic to their hybrids, however not through simple one-pair combinations with susceptible partners. Transfer of genes of resistance is hardly possible in direct crossing between two species. It

is necessary to introduce intermediate species or varieties, which would serve as a bridge. I. V. Michurin called them "go-between". History of development of such valuable varieties of wheat as "Prelud, Novinka, Aurora, Ardito, Magnif" shows the importance of multiple-phase crossings. In selection for immunity this way was utilized in the work with sugar cane. John Niederhauser, in Mexico, succeeded, finally, in developing a potato variety Erendira, which is highly resistant to blight in the place of origin of the parasite in Toluca (Mexico). The scheme of development of this variety is as follows:



In the selection of cultivated plants for high resistance to dangerous diseases one should, first of all, use the highly resistant and tolerant genotypes from the place of origin of the host and the parasite, and further on successfully utilize them in the gradual (bridge) crossings. Instruction about initial material for selection requires establishment of regulations for a planned introduction.

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Prutskov, F. M.

Kul'tura risa v Kitae

[Rice growing in China]

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20 V633

(In Russian)

Origin and Evolution of Cultivated Rice in China

It is known from Chinese literature that in China rice is a very ancient crop. This fact is testified by entries in the books of Kuan' Chzhi (700 years B.C. [n. e. New Era]), Lu Dia-sin (195 years B. C.), and Hua Nan'chzhi (122 year B.C.) in which cultivation of rice is mentioned. The antiquity of rice growing in China is indicated by other facts as well. For instance, rice plants and grains were found in excavations dating back to the New Stone Age in China (2,000 years B.C.). The word "rice" was found on bone writings [kostianala pis'mennost'] (1401-1223 years B.C.). Tribes of Yang Shao [ianshao] culture (3 thousand years B.C.) were already growing rice (5).

On the basis of the very oldest literary sources and contemporary investigations, a well known Chinese learned professor, Din In, considers that in China the cultivation of rice was begun

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approximately 5,000 years ago, that is, earlier than in any other country in the world; during the Chou Dynasty (1100-200 B.C.) rice planting was developed widely in the basin of the Hwang Ho [Khankhe] River (4).

In Soviet and in foreign literature it is indicated that the ancient countries that cultivated rice were India and China (1). Some authors believe that in India cultivation of rice was begun earlier than in China; in reality, however, the utilization of rice for cultivation was begun in India considerably later than in China. This can be confirmed by citing a fact such as this: the work "rice" (vr̥hi) was noted for the first time in India in the song "Atharva Veda" (1,000 years B.C.).

According to data on years of research conducted by a number of authors, in individual countries, the utilization of rice for cultivation took the following course: 1) in 1-2 centuries B.C. rice penetrated from China into Japan; 2) in the 9th century B.C. rice was exported from India to Iran, and from there to Europe, Africa and America; 3) in the year 1084 B.C. growing of rice was begun on the island of Java. On the Malay archipelago, rice was imported from the continent by [people of] Austronesian nationality and it was called by the Malay name of "Bras" and "Rady" (11). The Latin name of rice which is "Oryza" did not originate from the Hindu "Arishi" as was indicated earlier in the literature, but from the Ninboisk (Ou-Li-Zz) that later spread in India. The ancestral form of cultivated rice is considered to be the wild species

of O. sativa L. f. spontanea which is distributed in a number of countries of southern Asia. A form of wild rice of the same type was found in the marshy areas in the South of China.

As regards its morphological characteristics, the wild species is not very different from the cultivated rice forms, in particular, not from Oryza sativa L. subsp. Keng (the Japanese branch) and Oryza sativa L. subsp. Hsien (the Indian branch); the wild species has however, a more flocculent shrub, more fruitless blossoms, the grains in the tassels are arranged more loosely than in cultivated forms, and the wild form inherently loses a great deal of grain.

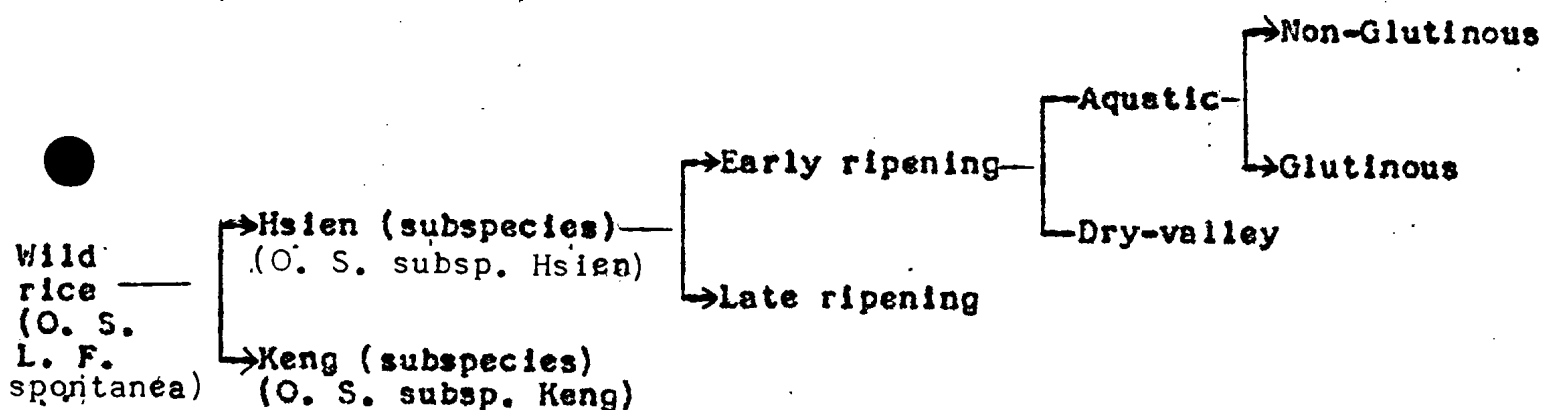
As a result of natural and artificial selection that has taken thousands of years, China has developed different forms and varieties of cultivated rice. Professor ^{Ting Ying} Din divides rice grown in the KNR [Chinese People's Republic] into the following forms: 1) varieties of the Hsien forms (O. S. L. subsp. Hsien) and Keng [forms] (O. S. L. subsp. Keng), 2) varieties of early (spring) and late (summer) planting, 3) aquatic and dry-valley rice varieties, 4) glutinous and non-glutinous varieties. These rice forms developed as a result of the influence exerted by external, environmental conditions*.

*In 1953, in a suburb of Loyang [Lolan], grains of the Keng form and of other forms were found in a grave of the Han Dynasty (206 years B.C. to 25 years A.D.). The rice cultivated at that time in districts situated south of the Yangtze River belonged to the Hsien form which is confirmed by entries made in the book "Shoven" during the 1-in epoch (1700 B.C.) where the word "Nanhaichzhi [or Nankhaichzhi]" denoting Hsien rice is mentioned. During the Sung [Sun] Dynasty (1011 A.D.) 1500 tons of rice seeds of the Hsien form were imported from the Fukien [Futsyzian] Province into districts north of the Yangtze River in which, from that time on, the area planted to rice of the Hsien form increased considerably.

[Footnote continued on next page].

The Hsien and Keng forms emerged under the influence of various climatic conditions: early-ripening forms (of early planting) and late-ripening (of late planting) emerged [Begin p.98] under the influence of dissimilar diurnal length at different times of the year; aquatic and dry-valley forms of rice formed under the influence of varying soil moisture; glutinous and non-glutinous forms developed as a result of variation occurring in the composition of starch during the cultivation process.

The evolutionary process of cultivated rice can be presented by the following scheme:



The Japanese scientist Kato (6,7), in 1928, divided rice in accordance with the fruitbearing degree of the hybrids and the serum reaction of varieties into two branches: the Japanese (Keng) and the

*[Continued from page 3]. Chinese scientists express the opinion that in the process of a long evolution and adaptation to conditions prevalent in the mountain districts of the tropics and in districts with a temperate climate, the Keng form exposed to the influence of temperature and other environmental conditions developed from the Hsien form. This hypothesis has been confirmed by data on research carried out by Chzhan Bei-lian' [or Veilian'] (10) and Chen Chzhu-shen' regarding the vertical distribution of the Keng and Hsien forms in the Yunnan Province.

Indian (Hsien) although the so-called Japanese strain (branch) was imported into Japan during the 1st and 2nd centuries A.D. from China where the Hsien and Keng strain had been isolated many years earlier.

Matszo (8,9), another Japanese scientist, collected 1431 varieties of irrigated and dry-valley rice and after investigating them, he divided all rice varieties on earth into three forms^S: A, B and C. The A form belongs to the Japanese branch of Keng which is distinguished by a stable stem, responsiveness^S to fertilizers, high productivity, dark-green color of leaves and its susceptibility to Piricularia [fungus].

The B form belongs to the Indonesian form of Keng which is characterized by a light-green color and a slight pubescence of leaves, a stable stem and a more considerable resistance to Piricularia than that of form A. The C form belongs to the Indian branch, that is to the Chinese form of Hsien; the leaves of the plants have a light-green color, the stem is less stable, the plants more resistant to Piricularia than those of form B. Matszo considers that these rice forms have developed under the action of diverse climatic and soil conditions at different latitudes of the globe.

Rice of the Hsien form that is more adapted to unfertile soils and to their water deficiency have become widely distributed in the Hwang Ho [Khuankhe] River basin. In the same districts are distributed rice varieties belonging to the Keng form.

On the shores of Lake Tai Hu [Taikhu], in the mountain districts of the province Hunan, Kwangtung [Guandun], Fukien [Futszian], Shensi [Tszian'si], and in the mountainous areas of the islands of Hainan and Taiwan, that is, in the districts with more fertile soils, is distributed rice of the Keng form. During the evolutionary process, the form Hsien became more adapted to conditions of a tropical and subtropical climate, and the form Keng to conditions of the warm belt and the mountainous districts in the tropics. At the present time, the varieties cultivated in the subtropical zone belong almost completely to the Hsien form which here is considered as the basic one.

On the basis of observations of the individual varieties in the province of Yunnan, Chen Chzhu-shen established the conditions required for the distribution of rice forms in zones in which two yields of rice are obtained within a year*. Varieties of the Hsien form are distributed in regions where the average yearly air temperature is above 17° , varieties of the Keng form - in regions with an average yearly temperature below 16° . The lowest air temperature (13°) is observed in the Litsien [Litszian] and Chaoton uezds¹. These areas are marked by a great deal of clouds and fogs, hence, here low rice yields are not infrequent.

*Average yearly temperature - above 17° [C], average for January - above 15° , average for October - above 20° .

¹[A rural administrative unit within a district equivalent to one in a U.S. county]

Vertical distribution of rice forms: varieties of Hsien forms are distributed below sea level; in districts located at an elevation of 1700 to 1900 meters above sea level are grown varieties of Hsien and Keng forms, but higher than 1900 meters - only Keng forms. According to observations conducted by Chen Chzhu-shen, in the belt in which both forms are grown are encountered varieties that are difficult to identify by their morphological characteristics. Grains of different forms (Hsien and Keng) are often found on plants of one variety. In the Yunnan Province cultivated rice is distributed [stretching] from the low hot areas (500 m above sea level) to the warm plateau (2400 m above sea level).

On the basis of his own investigations and observations and also on the generalized works of other authors, Din In calls rice of the Hsien type a subspecies (O. sativa subsp. Hsien). He believes [Begin p.99] that the Keng form has become differentiated and has developed from the basic Hsien type (2,4).

We consider that the facts cited above are sufficiently [convincing] to cause a change in viewpoints as to the origin of cultivated rice and that certain corrections be made in the classification of rice forms. It is desirable that in future the [term] "Japanese branch of rice" be replaced by "Chinese form of Keng" (O. sativa subsp. Keng) and the [term] "Indian branch" by "Chinese form of Hsien" (O. sativa subsp. Hsien). Changes of this type made in the classification will be in accordance with the historically evolutionary process of rice culture in China.

Realm and Ecological Characteristics of the Most Important Rice Forms and Varieties

In China, rice growing, especially of the irrigated kind, is widely distributed - from the province of Heilung^{Heilungkiang} [Kheiluntszian] to Hainan in the South, from the Island of Taiwan in the East to the Sinkiang-Uigur [Sin'tszian-Uigur] Autonomous District in the West. At the present time, 26 million hectares (26,69% of the area occupied by all other grain crops) are planted to irrigated rice, the harvest of [rice] grain comprises 45.64% of the total grain harvest in the country. From 1949 through 1956, the cropping area under irrigated rice in the Chinese People's Republic [KNR] increased by 7159 thousand ha, and the total grain harvest increased by 35475 thousand tons; average productivity per unit area (ha) increased by 6.61 centners. In the year 1956 the average productivity of irrigated rice comprised over 27 centners per ha, and in a number of southern districts it exceeded 75 centners per ha. In China, large areas are occupied by early irrigated rice: its share is approximately 25% of the total rice harvest in the country. In the year 1957, early rice grain was gathered on the average of 22,75 centners per ha - by 1.4 centners more than in 1956.

In Southern China natural conditions are more favorable for obtaining two, and in some districts even three, rice crops within a year. This zone includes the provinces of Chekiang [Chzhetszian], Fukien [Futszian], Kiangsi [Tsziansi], Hunan, Hopeh [Khebei], Shan^{Kwangtung}-tung [Guandun], Shensi [Guansi], Szechwan [Sychuan'], Yunnan [Iun'nan'], and Kweichow [Guichzhou]. the districts south of the

Hwang Ho River [in the] province of Kiangsi [Tsziansu] and Anhwei [An'khol], and also those south of the Tsin'lin [mountain] range that are part of the Shansi Province and of the provinces of Han'su and Tsin Hai. This zone has a warmer climate and the largest quantity of precipitation. In the Yangtze River basin precipitation reaches 1000 mm, the vegetative period usually lasts from 250 days to 300 days. In districts south of the Ulin range frosts scarcely ever occur, the average annual precipitation^{reaches} 1500-2000 mm. Here three crops per year are harvested. The southern part of this zone is in the subtropical belt where climatic conditions are very favorable for the cultivation of many agricultural plants. In this zone, over 60% of the entire tilled area occupied primarily by the rice crop is irrigated. The young crop of irrigated rice comprises a large portion of grain crop plantings.

As a rule, in the north-western and north-eastern zones only one rice crop is harvested. In the northern districts, the climate is comparatively cold, therefore, here rice plantings comprise only 5% of the irrigated rice area in the country.* However, in the Korean Ian'bin Autonomous Okrug** [Northern Korea] (Girin Province), the productivity of irrigated rice increased from 20.2 up to 37.5 centners per ha.

The distribution of rice forms according to zones and individual Chinese provinces is shown in the table.

*Earlier it was considered that the northern districts are totally unfavorable for irrigated rice growing.
**[Equivalent, more or less, to a district within a district of a U.S. county.]

Within the last thousand years, Chinese farmers created over 10 thousand irrigated rice varieties. Yet as a whole (according to the latest data), they number about 50 thousand varieties of irrigated, semi-irrigated and dry-valley rice [developed] by native farmers and breeders. There are in the ^[Kwangtung] Shantung [Guandun] Province alone 6717 native farmers' and breeders' varieties of early and late irrigated rice; of these 169 varieties have been recognized as deserving of widespread utilization in production. In the Scientific Research Institute of Agriculture of Eastern China (City of Nanking) a study is being made of 6000 rice varieties the majority of which were gathered in native provinces. Large numbers of native varieties are available in the southern provinces and in the North East. ¶ In the Chinese People's Republic, cropping areas under selected and improved varieties are on the increase. It is planned within the next few years to switch completely to planting from varietal seeds. The best varieties of irrigated rice are: Hsien-dao [Sian-dao], Keng-dao [Gen-dao], Hodao, Ludao, in the Hunan and Kiangsi [Tsiansi] provinces - Nantahao [Nantakhao] and Shenli-se. In the North-East the varieties of Iua-chzhi-2 and Chin-sh-5 are more distributed, in the northern regions of China - the variety In'fan'. In the eastern part of China, the highly productive varieties are: Nantahao, Shenlise, Chzhunnun-4, Chzhuiun-nun-853, 412, Lao Lechin. These varieties occupy 20% of the total cropping areas [allocated] for rice. Replacement of poorly productive farmers' varieties with highly productive ones will increase the country's rice production by an average 10-15%. [Begin p.100].

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At the scientific research establishments of the Chinese People's Republic is conducted important research work with a view to improving local farmers' varieties, replacing Hsien form varieties with those of the Keng form (in order to change rice with one yield for rice with two yields), and creating more productive varieties. On the basis of experiments in phase analysis of rice, conducted at the Scientific Research Institute of Agriculture of Eastern China, it has been established during the last seven years that passing through the vernalization stage required temperatures of 15° - 30° [C], depending on the variety. The passing through the vernalization stage at optimal temperatures required 12 days. The vernalization stage cannot be accomplished at temperatures of 3 - 5° .

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Table

Zones	Provinces	Forms of Rice
North-East	Central and Northern Manchuria (north of 42° north latitude)	Early ripening and ultra-early ripening Keng form varieties at a high latitude; there occur a few Hsien form varieties at high latitude
Rice seeding districts Hwang Ho River basin	Southern part of Manchuria. Provinces of the middle and southern current of the Hwang Ho River	Early ripening, medium ripening and medium-late ripening Keng form varieties
The North-West	Han'su and Sin'chi-an-Uigur Autonomous Oblast'	Early ripening Keng form varieties. Earlier there were ultra-early ripening Hsien form varieties of high latitude
Zone of elevated areas (plateaus)	Elevated areas of the Yunnan, Guichou and Szechuan provinces	Hsien form varieties of elevated areas of low latitude and Keng form varieties of elevated areas (including the distribution of the Shanlichen variety the grain of which is 3 mm long and is bare with non-pubescent leaves)
Rice seeding districts in the Yangtze River basin	Provinces of the middle and lower current of the Yangtze River	Medium and late ripening varieties of the Keng form, early, medium and late ripening varieties of the Hsien form (the Shanlichen variety has also been encountered)
Rice seeding districts of the Chutsian River basin	Southern part of the Yunnan Province and the provinces of Kiangsi [Guansi], Guandun, Fukien [Futszian'], and Islands of Taiwan and Hainan	Early ripening Hsien form varieties of low latitude, late ripening Hsien form varieties (the Shanlichen variety is encountered) and the gummy varieties of the Keng form. At present, other Keng form varieties are also being distributed.

glutinous

As regards the light phase, the rice varieties distributed in China can be divided into two groups. The first group is comprised of varieties that are not sensitive to the length of day. These include the early ripening varieties in the southern part of China, early-ripening and medium ripening varieties of in Central China, and the medium ripening varieties of the North-East and North-West. In long day (18 hours) [cultivation] the varieties of this group are a little late in heading, and in short day (10-12 hours) not over 30 days.

The second group is composed of varieties sensitive to the length of day. It includes varieties of the southern districts of China and varieties grown in the rest of the districts for the purpose of obtaining two yields per year. These varieties are very late in heading when grown during 18-hour long days. There is a certain relation between the passing of the individual stages of development and the reaction of plants to a long day. [Begin p.101]. For instance, rice varieties of high latitude regions react poorly to lighting.

Natural conditions of China contribute toward the formation of various ecological types of rice, hence different ecotypes are encountered even within the limits of one form or one variety.

Agrotechniques for Obtaining High Yields of Rice

Rice is one of the highly productive grain crops in China. In a number of volosts*, uezds** and provinces, high and stable rice yields are obtained on large areas. The productivity of this and other crops has increased especially as a result of the cooperation extended by China's agriculture.

Chinese rice growers achieved outstanding successes in the year 1958. In the Provinces of Anhwei [An'khol], Hupeh [Khubei], Kiangsi [Tsziansi] and Honan [Khenan'], on an area of 1,154,666 ha planted to early rice, the average yield obtained was 75 centners per ha. In the Province of Honan [Khenan], average productivity of rice reached 104.4 centners per ha, in the Province of Kiangsi [Tsziansi] - from 75 centners up to 225 centners [per ha] on an area of 76666.6 ha. In the Dan'chen Uezd of the Honan Province the per hectare average of the productivity of early rice amounted to 412.5 centners [per ha], and on a field comprising an area of 1.79 ha it was 675 centners [per ha].

On the agricultural cooperative [farm] "Poputnyi Veter [Trade Winds]", Hupeh [Khubei] Province, the yield of rice grain harvested on an experimental field in the year 1958 was 1219.5 centners per ha. On an experimental field of the cooperative [farm] no. 2, Machen Uezd, Hupeh [Khubei] Province, the rice yield was 1219.5 per ha., on

* [A rural administrative unit within an uezd.]

** [An administrative district equivalent, more or less, to a district within a U.S. county.]

the cooperative [farm] "Tsian'go" - it was 2772 centners. On the cooperative [farm] "Dunfangtung", Anhwei [An'khol] Province, the rice gathered on an area of 1.03 mu* amounted to 3231 centners per ha.

A very high rice yield was obtained in the people's commune of the village Sinli near the City of Tientsin. Here, on an experimental field measuring 1.025 mu were gathered 63 tons [sic] of dry grain which, when converted, amounted to 921.95 tons [sic] per ha. Prior to inflorescence, the rice plants were transplanted onto this small field from an area of 40 mu (2.666 ha). The rice was planted so close that it reminded one of a thick green carpet.

The obtaining of high rice yields is a resultant of the untiring work of Chinese farmers and of the use of the achievements of science and advanced experience.

On leading farms a great deal of attention is paid to agro-technics. Seeds are wetted preliminarily prior to germination, then they are planted on well fertilized seedbeds. Only healthy, well developed seedlings are used for planting. In each hill on the seedbeds are planted 4-6 rice plants. The basic fertilizers used on rice fields are soybean oil-cakes, ammonium sulfate and other types of fertilizers.

The fundamental agricultural methods used on experimental fields of cooperative [farms] were as follows: plowing was carried out at a depth of 50-60 cm, fertilizers were applied in layers in large quantities (manure, leaves of bast crops, bone meal and mineral

* 1 mu comprises 1/15 of a hectare.

fertilizers). In planting rice seedlings, density of the plants was brought up to 105-129 million stems per hectare instead of 900 thousand, or 1,050,000 [1050 thousand] stems. During the whole period of rice vegetation the plants were tended carefully: irrigation was carried out on time, weed control was conducted, the young crop was protected from winds (with the aid of screens), birds were scared away and other measures were conducted.

At the agricultural cooperative "Yungun", river silt used as the basic fertilizer was applied at the rate of 37-40 tons per ha under early rice and 120 tons per ha under late rice. In addition, large quantities of a mixture of liquid mud and manure ("utsu") and different waste materials were used as fertilizers.

Deep plowing and careful, repeated harrowing create a loose tillable soil layer, contribute toward a normal development of the soil system and make nutritive substances available to it. Winter plowing is practiced (at a depth of 18-20 cm) and harrowing of dried out rice fields (of early and late rice) is carried out 12-13 times. Fields designated for seeding of early rice are plowed the first year before winter sets in, and fields for seeding of late rice are plowed at the time when early rice is harvested, as the fields are freed. Then the fields are drained so as to enable the soil to absorb water readily when it is irrigated and to enable its mineral salts to dissolve in the water. In the Yungun cooperative and in other leading farms irrigation of fields is carried out after the water that entered the fields during the preceding irri-

gation has been completely used up.

Three to five days after the appearance of sprouts when the plant has 15-16 stems, water is drained from the fields of early rice. Fields occupied by the young crop of late rice are drained approximately 45 days after the appearance of sprouts when branching has reached 17-18 stems. The fields are left without water until the surface has hardened which is conducive to branching and strengthening of the root system of rice plants and also prevents their early lodging. [Begin p.102]. After the fields have dried out they are again watered.

Leading farms introduce fractional [drobnoe] and concentrated fertilizers into the soil (so-called fertilizing of spikes), that is, fertilization during the period of heading or inflorescence of tassels, and the tail-end (khvostovoe) fertilizing - introduction of fertilizers shortly before the ripening of rice. On the fields of late rice, fertilizers (30 tons of utsu [mixture of liquid mud and manure] and 60 kg ammonium sulfate per ha), as a rule, are introduced at three [different] stages. Apart from the [application] of the basic organic fertilizers, fields of early rice are fertilized twice: prior to heading and before [sic]* heading, and on the fields of late rice three times: prior to heading, during the heading period and shortly before heading is

* [Probably "during" or "after" heading].

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completed.

Inter-row treatment and weeding on fields of early rice are carried out twice, and on fields of late rice - three times. Planned treatments of inter-row, weeding, irrigation, timely draining off of water from fields and introduction of fertilizers, as well as many other measures contribute toward obtaining high rice yields.

On the state farm of Fuchen (Linshan Uezd, Kwangtung [Guandun] Province), high stubble, up to the very tassel, is left when the yield is harvested and later it is plowed under. Using this method, as well as other agrotechnical measures, the state farm of Fuchen, which is situated on clayey soils, has improved the soil structure and increased soil fertility. In the year 1955 the state farm harvested 77.5 centners per ha of grain and, by virtue of rice productivity, became one of the leading farms in the Tien-shui [Tsin'chou] district.

The soil-climatic conditions of China are very specific, yet many agrotechnical method used in growing rice can be applied to the rice growing regions in the USSR as well.

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[English summary on page 102;
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on page 103]

Klabukov, P.

Mezhdunarodnoe soveshchanie po razvedeniiu i
iskusstvennomu osemeneniiu krupnogo rogatogo
skota

[International Conference on Breeding and Arti-
ficial Insemination of Cattle]

Vestnik Sel'skokhoziaistvennoi Nauki, vol. 4,
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(In Russian)

In February of 1959 a Conference was held in Moscow by the working group of the Permanent Committee on Economic and Scientific Technical Cooperation within the Realm of Agriculture between Member Countries of the Council for Economic Mutual Assistance [CEMA]; the principal problems discussed were the breeding and artificial insemination of cattle.

The Conference was attended by delegates from 10 countries. Nine reports were heard and discussed at plenary meetings. Board Member of the Ministry of Agriculture USSR, P. Esaulov, presented a report titled "Structure of breeding farms and breeding manage-
ment in the USSR and in countries of ^{the} people's democracies". He dwelled briefly on the history of the development of breeding in the USSR and noted great successes in creating purebred livestock.

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in improving old and in developing new cattle breeds. He demonstrated, by giving specific examples, the achievements ^{in the} and increase of cattle and in raising its productivity during the last five-year plan as a result of the completion of measures providing for a steep rise in agriculture planned by the September Plenum of the Central Committee KPSS [Communist Party of the Soviet Union] (1953). At the same time the speaker pointed out a number of shortcomings in the organizing of breeding matters and artificial insemination of cattle in the USSR. In connection with the increased tasks of raising the production of livestock products, the reconstruction of the structure and system of breeding management begun in recent years is being continued in the USSR. This structure provides State and kolkhoz breeding plants (elite farms) for the basic cattle breeds (they are produced at the base of the best breeding sovkhoses, horse plants, kolkhoz breeding farms, experimental farms of scientific research establishments and training establishments that have the most productive pedigreed cattle); breeding and reproduction farms that are being organized at the base of breed-
sovkhoses
ing and the better industrial sovkhoses, kolkhoz breeding farms, experimental farms of scientific research establishments and training institutions; State breeding work and artificial insemination stations that are being organized, primarily, at the base of the State breeding nurseries and the State factory stables; State, interkolkhoz and kolkhoz stations for artificial insemination (being organized on sovkhoses, training and experimental farms,

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on the better breeding farms of kolkhozes, and at district veterinary hospitals).

In characterizing breeding systems in countries of the people's democracies that have formed from accounts of national experience and characteristics, the speaker arrived at the conclusion that fundamentally they are similar to the breeding system in the USSR.

In the report "Breeding of purebreds as a method of improving cattle", by Doctor of Agricultural Sciences, E. Novikov, problems of breeding purebreds and of its role in matters of pedigree in the zootechnical evaluation of animals, selection and preference when breeding purebreds were examined. On the basis of analytical data of the USSR and of countries of the people's democracies, the author of the report demonstrated that the desirability of using one breeding method or another is determined by the development of breeding, the level of productivity and the degree of animal improvement. In districts in which pedigreed livestock raising is developed and cattle productivity is high, the basic method is the breeding of purebreds. In oblasts in which cattle has been improved but little and in districts that raise marketable (non-pedigree) livestock, it is possible to use the method of crossing with a view to breed transformation of cattle and a rapid increase in its productivity. In the USSR and in countries of the people's democracies the value of animals is determined by a complexity of characteristics, such as origin, appearance, development and productivity. Having analyzed critically the methods for animal evalu-

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ation approved of in instructions for the appraisal of cattle and for the registration of animals in pedigree books, [Begin p.134] the speaker demonstrated that in making a more complete and accurate animal evaluation it is necessary, in particular, to take into consideration the: productivity of cows for no less than three lactations; ^{butterfat} ~~fat~~ and protein content in milk; returns from production [compensating] for expenditures for rearing, feeding and maintenance of dairy cows; generalized indicators of milk production and pedigree; indicators of direct ancestors (mother and father) and nearest relatives (sisters, stepsisters, brothers); objective indicators of external evaluation and of the quality of beef from cattle of different lines [napravlenii]. Taking these indicators into consideration, more improved and more simple methods of animal evaluation should be worked out. In E. Novikov's report, much attention was paid to the analysis of methods to be used in the evaluation of breeding bulls as to the quality of progeny and the further improvement of these methods. The speaker dwelled also on the characteristics of selection and mating [podbora] methods under conditions of wide-spread use of artificial insemination.

The VASKhNIL Academician, N. Rostovtsev, presented his report "Effectiveness of various crossings in dairy cattle". From the position of Michurin's materialistic biology and Pavlov's physiology, he at the beginning analyzed a number of theoretical problems of breeding and improving animal breeds. The speaker demon-

strated the role and the place of different methods for breeding and crossing purebreds in raising pedigree and utilitarian cattle, the need of a substantiated choice and of the combination of these methods in relation to the specific conditions of the farm and the composition of the herd. In confirmation of the fact that interbreed crossing does not always produce the desired results, Academic N. Rostovtsev cited examples of unsuccessful crossing of East-Friesian cattle with Iaroslav and Brown-Latvian, and Red-Steppe [cattle] with East-Friesian. In the second part of the report, Academician N. Rostovtsev acquainted [his listeners] with the results of his long experiments in crossing Black-Spotted cattle with Red Zebu and Gray Ukrainian with Kostroma which he conducted at a number of sovkhoses in the different zones of the country. The results obtained in these experiments were good. On the basis of the data obtained, Academician N. Rostovtsev arrives at the conclusion as to the desirability of utilizing hybrid bulls of the first and second generations with Black-Spotted and Red Zebu blood in utilitarian herds of Black-Spotted cattle with the objective of increasing butterfat in milk. For a further improvement of hybrid animals and the strengthening of their inheritance of butterfat and abundance of milk, he recommends crossing second generation hybrid cows of Black-Spotted blood with second generation hybrid bulls of Red Zebu blood.

In the report "Improvement of a dairy herd after the experience of the pedigree sovkhos 'Karavaevo'", by Doctor of Agricul-

tural Sciences, S. Shteinman, which was read by A. Mitropol'skaia, were examined the methods of breeding work used on this sovkhos and the data obtained. As a result of systematic, thorough breeding work, improved feeding and conditions of maintenance, a highly productive herd of dairy cattle of the Kostroma breed has been produced on the "Karavaevo" sovkhos and animals excelling in productivity not only during one lactation, but during their entire life were obtained.

In the report by Candidate of Agricultural Sciences, F. Eisner, certain organizing and methodological problems of evaluating breeding bulls of dairy and meat-dairy breeds were elucidated. The use of breeding [bulls] that considerably surpass the mother stock as to their qualities and firmly transmit these qualities to the progeny is one of the most effective means of improving cattle rapidly. The importance of such breeding bulls has increased especially in connection with the mass use of artificial insemination from which a thousand and more calves are obtained annually from one bull. The breeding value of bulls can be determined more accurately by examining the quality of their progeny. A bull cannot, however, be evaluated by the milk production of his female progeny before they are 5.5-6 years old, when they finish their first lactation. Up to this age the breeding value of a bull must be judged by its origin, appearance and development. Hence the speaker deems it necessary to continue work on the improvement of methods for the evaluation of bulls by their pedi-

gree and individual properties.

In the opinion of the speaker, a direct evaluation of the productivity of the bull's female offspring under the usual farm conditions and a simultaneous comparison with their mothers as well as with [heifers] of their own age. In using any evaluation method, the problem of the unification of indicators of the amount of milk produced in one milking, with due consideration of the animals age, is the most complicated one.

The report "Contemporary situation and prospects of artificial insemination of agricultural animals", by VASKHNIL Academician, V. Milovanov and Prof. I. Sokolovskaya (the report was read by I. Sokolovskaya), reviewed briefly the history of the development of artificial insemination in the USSR and other countries, its role in increasing animal productivity, in hastening the creation and further improvement of pedigreed cattle [Begin p.135] and the scale^{of} use in different countries.

In the USSR, the GDR [German Democratic Republic - Communist], the Hungarian People's Republic and in other countries, apart from the oblast' and rural district [okrugnye] stations, central stations for artificial insemination have been established. These stations house the best breeding bulls, chiefly of an elite class and an elite record which, however, in most cases, have not as yet been tested as to the properties of the progeny. For the purpose of increasing fertilization, the authors of the report recommend practicing varied feeding of the bulls and cows. To insure total nutritionness and food value. the rations of breeding

bulls must include 70-75% of the grain portions of plants, and conversely, the rations of cows, 70-75% of the green portions of plants.

The basic problems of the technique of artificial insemination were critically examined in the report. Special note was made of the need of producing instruments and materials for artificial insemination from synthetic materials that insure low prices, simplicity and better sterilization.

Corresponding Member of VASKhNIL, N. Burlakov, in his report, elucidated certain problems of organizing efficient use of cattle which, in connection with the tasks set for a sharp increase in the production of meat and milk, and a decrease in their net cost, acquire exceptional importance.

The speaker cited data to the effect that in the USSR the age of cows at their first calving is very often 33-36 months, in the GDR - 30-33 months, in Czechoslovakian Republic - 27-33 months etc. On the basis of an analysis of available material, the speaker arrived at the conclusion that in cases of feeding full value feed and normal development, heifers of dairy and dairy-meat breeds can be inseminated for the first time at the age of 15-16 months. Milk production during the first lactation when calving occurs at a younger age is usually somewhat less than when calving occurs at a more mature age, but the total quantity of milk and calves obtained during the whole utilization period is greater in the first [younger] cows.

On the basis of an analysis of data on scientific experiments and practice at individual farms, the speaker finds it desirable to reduce the dry [sukhostoinyi] period of cows from 60 days to 35-45 days. In determining the duration of the dry period, it is necessary to take into consideration the state of being well-fed, productivity and the level of feeding dry cows.

In the report, considerable attention was paid to problems of increasing beef production. In examining problems of loose cattle maintenance and of mechanizing labor in animal husbandry, the speaker noted that their utilization in practice will provide a sharp increase in labor efficiency in animal husbandry and a decrease of the net cost of meat and milk.

In the report of the active member of the Ukrainian Academy of Agricultural Science, P. Pshenichnyi, titled "Fundamental problems of directing [upravlenie] the ontogeny of agricultural animals", the general principles of the regularities of the growth and development of organisms under the influence of conditions of external environment, and also problems of directing embryonic and postembryonic development of agricultural animals were examined briefly from the position of Michurin's biology and Pavlov's physiology. In the opinion of the speaker, it now has been sufficiently well elucidated when, under the influence of the surrounding environment, tissues, organs and entire animal organisms are most variable.

The youngest and least differentiated tissues, organs and organisms are the most plastic. Organisms in the developmental stage that are ready to pass from one stage into another, and organisms with a shattered heredity are subject to the most notable changes. Noticeable changes may appear in the tissues, organs and in the entire organism of growing and of adult animals with a more intensive metabolism and more intensive activity. Knowledge of these regularities permits animal breeders to approach the guidance of organism development with greater substantiation.

Candidate of Veterinary Sciences, I. Messarosh (Hungary) presented a report on control methods for sterility in cattle. For the purpose of preventing sterility, he first of all calls attention to the need of proper rearing, feeding and maintenance of cattle. Besides the general nutritiousness of feed rations, it is essential to take into consideration their complete food value. Deficiency of mineral substances, especially phosphorus and calcium, vitamins and microelements in rations may cause sterility in animals.

I. Vani reported that in the Hungarian People's Republic breeding of purebreds is the basic method for improving cattle. Besides this, good results have been obtained in experiments conducted in crossing Hungarian Red-Spotted cattle with Kostroma cattle. The hybrids of the first generation produce an average milk yield of 3-4 thousand kilograms with 4.5-4.8% of butterfat.

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Professor Jan Palonk (Poland) noted that in breeding, he and his colleagues employ complex evaluation of the animals as to origin, external appearance and development, productivity and quality of offspring. [Begin p.136]. A great deal of attention is paid to type and correct body structure of the animals, and also to the structure and form of the udder. In the evaluation of the udder, 20 points are separated out of 100. Animals that are given an udder evaluation below 10 points are not entered in the GPK [State breeding register]. Selection and evaluation of sires is carried out in accordance with a developed method. On breeding farms, an effort is made to utilize breeding bulls only after they had been evaluated as to pedigree, type of body structure, quality of semen, as to growth and development of the offspring obtained and the productivity of daughters during the first lactation. Breeding bulls verified as to the quality of their offspring are used until they^{are} 16 years old.

Doctor K. Bartch [or Barch] (GDR) dwelt in his address on work conducted in determining protein in milk. On the basis of investigations of the properties of milk obtained from the daughters of 11 breeding bulls undergoing tests, he established a close relation between the content of butterfat and protein in milk. According to his data, there has been observed between butterfat and protein in the milk of cows a correlation coefficient of 0.5-0.7 and a regression coefficient of 0.3-0.5.

Doctor I. Kurtov (Rumanian People's Republic), in his address, noted that ^{he} and his colleagues are drawing from the experience of the USSR and other democratic countries in improving the organizing of breeding work and of artificial insemination. The Republic has established centers for artificial insemination and for the control of sterility, a central organization for the distribution of breeding sires and the supply of zooveterinary equipment.

Ian Mozola told about his experience in organizing breeding work and artificial insemination of cattle in the Czech Republic. He dwelt in particular on problems of selection and mating in linebreeding, of using inbreeding, of annual appraisal of purebred herds, of typing herds on cooperative farms, and also on the development of new methods for storing bull semen by means of deep-freezing and preservation with carbon dioxide.

Professor M. Lebedev dwelt on problems concerning the organizing of breeding work under conditions of wide-spread use of artificial insemination. On the basis of experimental work conducted in the Leningrad Oblast', he outlined a plan for specific measures.

Professor E. Arzumanian noted the need for further improvement of methods for the evaluation of bulls by [the records of] their daughters on different farms, for the determination of the age of heifers with a view to their first insemination depending on breed and other conditions, and for specialization in cattle breeds. He especially emphasized the need of using sanitary measures in herds of breeding farms at the earliest possible date.

1u. Shmel'ttser [or Schmelzer] reported about an experiment in breeding practices and measures implemented for their improvement in the German Democratic Republic. Much attention is paid to the organizing of productivity controls. Cows under control comprise 92% [of their total number]. Twelve control tests are carried out annually. In the evaluation of bulls, the general development and external appearance are taken into consideration. Bulls are not admitted for appraisal if their mothers do not conform to type as to body structure or correct structure of the udder. In the State Breeding Register, entries are made for the total milk production [of a cow] as well as for each part [dolia] of the udder. In the year 1958, artificial insemination in the Republic was carried out on 56.8% of the cows and heifers. Replacement of bulls attached to a farm is carried out every 2.5-3 years.

Doctor of Veterinary Medicine, T. Maevskii, reported that large stations for artificial insemination (30-40 bulls in each) have been established in the Polish People's Republic. In most stations semen is stored at 0-4° [C] temperatures. At some stations, tests are made of methods for storing semen at a 79° temperature and by conservation of acids.

As a result of discussion of reports and information furnished, the Conference adopted a series of important recommendations.

The delegates to the Conference noted unanimously that a regular exchange of experience between countries of the people's

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democracies will assist in accomplishing the tasks laid down
for a sharp increase of the production of livestock products at
the earliest possible date.

Konstantinov, P. N., and Plotnikov, N. IA.

K voprosu o metodike polevogo opyta

[On the methods of field experiments]

Vestnik Sel'skokhoziaistvennoi Nauki, vol. 4,
no. 6, p.35-42. June 1959. 20 V633

(In Russian)

Correct organization of field experiments appears to be one of the most important conditions of agricultural research. All agricultural procedures (methods of soil cultivation, planting, kinds and norms of introduced fertilizers), as well as the studied varieties, must be given comparative scientific-agricultural and economic evaluation under definite specific conditions of the experimental establishment and of agricultural production. Field experiment permits detecting production importance of these or other agrotechnical processes or of the introduced new crops and varieties in close connection with the industrial and natural conditions. It is possible, on the basis of data of a correctly conducted field experiment, to obtain important conclusions for the agricultural industry.

Prof. P. N. Konstantinov, Active Member-Academician of VASKHNIL [All-Union Academy of Agricultural Sciences imeni V. I. Lenin]; N. IA. Plotnikov, Candidate of Agricultural Sciences, Moskovskaya Sel'skokhoziaistvennaya Akademiya imeni K. A. Timiriazeva [Moscow Agricultural Academy imeni K. A. Timiriazev]

It was yet in the report of the President of VASKHNIL [All-Union Academy of Agricultural Sciences imeni V. I. Lenin], P. P. Lobanov, at the Jubilee Session of the Academy, dedicated to the 40th Anniversary of the Great October Socialistic Revolution, that attention was drawn to the necessity of paying special attention to questions of methods of the experimental work; this should provide for the increase of accuracy and authenticity of scientific data.

At the same time Academician P. P. Lobanov mentioned that at many institutes and experimental stations improvement of methods of the experimental work is not any more a subject of constant attention and care, while many scientific workers do not even use the required and the most objective method of mathematical analysis of experimental data.

We became familiar with the work of individual varietal plots after studying data, published in the information bulletins of the State Commission on variety testing of agricultural crops, as well as the reports, presented to VASKHNIL, by the All-Union Scientific-Research Institute of Fertilizers and Agricultural Soil Science. As it is known, the central apparatus of the Gossortset' [State Network of Agricultural Experimental Stations] provides leadership in all the work of State Varietal Plots; and the methodical supervision of experiments with fertilizers in the geographical network was entrusted to VIUA [All-Union Fertilizers and Soil Study Institute]. It is pertinent to point out that both the central apparatus

of Gossortset', as well as the VIUA, which have highly qualified cadres of scientific workers and specialists, pay great attention to problems of methods of field experiments. Nevertheless, at State Varietal Plots and in the work of the Geographical Network of Experiments with Fertilizers, serious violations of methods of the field experiment and of agrotechnique are being discovered. Let us cite several instances. Thus, in 1956, at the Pii-Khensk Varietal Plot, in Tuvinsk Autonomous oblast', oats were harvested without an accounting according to replications in various systems of soil cultivation. Khovalinsk Varietal Plot, Tadzhik SSR, also calculated the yield of oil flax varieties not by sections, but summarily. At the Min'iarsk Varietal Plot, Cheliabinsk oblast', harvesting of the yield was conducted one month after the ripening of spring wheat and oats in the experiment on variety tests; at the Kitabskii mountainous Varietal Plot, Uzbek SSR, varieties of oil flax were harvested in 47 days after ripening; this led to great losses in yields. After such [Begin p.36] most flagrant violations of methods, data of experiments cannot be taken into account. Exceptionally careless behavior in regard to scientific research, was permitted by V. M. Takmurzin, former superintendent of the Gorno-Mariiskii Varietal Plot in Mari ASSR, who systematically upset the methods and agrotechnique of the experiments. In 1956, he conducted a summary harvest (for a series of experiments) of grain crops, ignoring the compulsory accounting of the yield according to replications. Comrade Takmurzin, both in his initial

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records and in his annual report, showed the yield of grain according to replications in order to escape the responsibility for violation of methods of experiments. Of course, single cases cannot characterize the work of the system of State Variety Tests as ^a whole. It was shown in a short report about the results of variety tests of agricultural crops for 1956, printed in 1957, that the greatest number of varietal plots conducted the experiments on variety tests of agricultural crops without any violations of methodical and agrotechnical instructions of the State Commission and the experiments were accepted with a satisfactory and good evaluation. Yet, it is recorded in this same report that in individual cases deviations took place from methodical principles, accepted by the State Network of Agricultural Experimental Stations.

Basic violations of methods and agrotechnique at the State varietal plots are as follows: planting with an insufficient number of replications; planting of varietal seeds without the standard variety or a control variant; incorrect planting in respect to various predecessors; inaccurate conducting of analyses; planting on poorly cultivated soil; violation of planting dates, absence of sufficient care, violation of the irrigation regime, violation of dates of harvesting and threshing of the yield, and others.

In many cases, in 1956, the experiments of industrial testing of varieties were not accepted in view of the fact that varieties were planted after different predecessors on different dates; different systems of harvesting were used, as well as recording

of yields of various varieties by different methods, and so on.

According to data of the State Commission, in 1956, 2,645 experiments, or 2.2% of the general number of conducted experiments were rejected, while in industrial testing - 320 variety experiments, or 5.2% of the number of the conducted experiments.

At the Ak-Kavak Experimental Station of VIUS (Uzbek SSR), in 1957, an experiment with fertilizers under cotton was laid out in a fourfold replication on a plot of 1057.4 sq. m. Differences in yields according to replications conspicuously exceeded the differences in the variants of the experiment. Yields of the first and second replications, which were situated in the first "larus" [stage, row or bed], were considerably lower than the yields of the third and fourth replications of the second bed. Evidently conditions of the environment, and, in the first place, the degree of fertility of these beds were different. It is impossible to analyze data of these experiments and draw correct conclusions from them.

In the experiment, conducted, in 1957, at the Oshsk Experimental Station, Kirghiz SSR, in which doses and dates of introduction of nitrogen under cotton were studied, very variegated data of yields, according to replications, were also obtained and did not permit the making of correct evaluations of variants of the experiment. In the report of VIUA on studies of forms of mineral fertilizers in the Geographical Network for the years 1956-1957, defects were pointed out in the conducting of experi-

ments at some of the experimental establishments; departures from the suggested schemes of experiments and methods, accountings of yields by insufficiently accurate methods, arbitrary exclusions, with giving any reasons, of data on yields of individual replications; absence of data on agrochemical characteristics of the soil of the experimental plot; insufficient conducting in experiments of necessary research and observations; absence of mathematical analyses of experimental data, and others. Variegation of data on replications in a series of experiments must be considered an essential defect. [Begin p.37].

Professor P. G. Naidin in his speech at the All-Union Convention of Workers of Agricultural Science (in 1956), while discussing the results of field experiments on the study of organic-mineral mixtures, conducted by the experimental establishments of the Geographical Network, emphasized that out of 125 experiments 79 were acknowledged as reliable, or 63%; the remaining 37% of experiments were rejected. Many experiments were rejected by the experimental institutions themselves. P. G. Naidin came to a conclusion that not less than 50% of field experiments, conducted at the experimental stations, proved to be defective. There are still more rejections of experiments that are conducted directly at the kolkhozes.

Many scientific-research establishments, State Agricultural Experimental Stations and State Varietal Plots conduct their experimental work in compliance with the accepted methods; this

then permits, on good grounds, recommending to the industry more improved and effective agricultural measures, new crops and varieties that are prospective. Apparently, the most widely used methods in the experimental establishments of USSR, are the nonstandardized checkerboard [shakhmatnyi], as well as the standard-paired percentage method in field experiments, which provide for obtaining dependable, trustworthy data. It is necessary to pay the most serious attention to the choice of the plot of land in laying out the experiments. A detailed physical-chemical and morphological soil examination must precede the selection of the plot. The plot must be typical, situated on the predominant type of soil with the most unvarying typical relief, plants, etc. Besides the natural soil variegations, the plots can differ also on the strength of their previous use under various experiments with a different tillage of the soil, with the introduction of various fertilizers to different size areas, and so on. Therefore, it is necessary carefully to study the history of the section before laying out an experiment. Knowledge of the history of the section will permit conducting the soil examination with a greater effectiveness; also, better to understand the variegation of the field and to organize the methods correctly. Work on an unstudied plot, as a rule, leads to the fact that the researcher commits a gross error, while recommending agricultural methods, varieties, and so on that were not well-grounded in the experiment, and, thus, impairs the agricultural industry.

The possibility of conducting an experiment on an unstudied, unknown plot is excluded in general. Unfortunately such errors are yet permitted in field experiments. For example, an experimenter, under conditions of irrigation in Rostov oblast', while studying the structure of the yield of spring wheat, compared the obtained data according to two varieties: Melianopus 69 and Al'bidum 43, which were planted: - the first over spring plowing (predecessor - cotton), and the second over fall plowing (predecessor - winter wheat). More than that, the yield of grain of spring wheats per hectare was determined in the experiment according to two sample sheaves, that were harvested from a single square meter of the planting.

As a preliminary examination before conducting the experiments, we consider it absolutely necessary to carry out trial plantings on slightly studied plots for the purpose of making more precise (for definite specific conditions) the basic elements of methods of the field experiment: the size of plots, number of replications, accuracy of the experiment, shape of plots, and so on.

None of the physical-chemical soil analyses (although they are needed) from the experimental plot can give such a detailed idea about the variegation of the soil fertility, as a fractional accounting of the harvest. The plant proper appears to be the best reagent to the soil and other variegations of conditions of the environment. Knowledge of the history of the plot, data on soil examination and trial planting are the basic materials for

the formation of methods for field experiments. If there is no need for making trial plantings in conducting experiments under production conditions [Begin p.38] (provided the experiments are laid out on large plots with a sufficient number of replications), then in experimental crops rotations, under stationary conditions, the trial plantings must be conducted without fail.

In our country not enough attention is yet paid to the quality of the planting material and to the origin of seeds. At certain State Selection Stations and Varietal Plots in one and the same experiment seeds of some varieties are used with a germination of 80-85%, while others with a higher germination (95% and over), and often nonconditioned seeds are used (according to varietal purity and typicalness).

In State variety tests it is especially important to take into consideration the effect of the place of origin of seeds on the yield, when varietal plots receive seeds (for comparative testing) from selection stations (originators of seeds), which work in the most diverse soil-climatic zones. It was established, that seeds of one and the same variety (grains, those requiring cultivation ["propashnye"], or other crops), which were brought in from other zones that sharply differ in nature, produce different yields when compared with the yield of seeds of local reproduction. Testing the seeds, obtained from different geographic zones, can lead, and often does, to inaccuracy and most gross errors, because the aftereffect of such a factor, as the origin, does not permit, with

sufficient authenticity and correctly, to evaluate the varieties during the first year of varietal tests. It is necessary to aim, taking this into consideration, at such an organization of variety tests that the varietal plots would be provided (for experimental purposes) with seeds of different varieties, preferably of local reproduction and of high varietal purity. One should not disregard this rule also in agrotechnical experiments.

Without starting a discussion of different opinions on the problem of the size of the experimental plot, we think it necessary to stress, that the size of the plot is determined in relation to the problem of research, to the variegation of soil fertility, kind of experimental plot, agrotechnique, and others. Individual central organizations, which conduct scientific-methodical supervision of a large network of experimental fields, situated in various soil-climatic zones, not so long ago legalized the experimental plot for many crops to be the size of 100 sq. m with a 4 to sixfold replication. From our point of view such recommendations require a serious reason. It is necessary to take into consideration an intricate complex of conditions of the place of the experiment's layout and of its purpose. That is the reason why it is difficult to form such universal, infallible methods. Nevertheless, basic principles for methods of the field experiment must be worked out and improved by means of extensive carrying-out of methodical experiments. In practical experimental work certain adherence to basic elements of methods must be followed. Thus, apparently,

one can accept the recommended area of plots for many natural zones, and, in particular, 50-100 sq. m for crops of continuous planting, and 100-200 sq. m for crops requiring cultivation, which are tilled with breaks. In field experiments, laid out under industrial conditions of kolkhozes and sovkhoses, it would be proper to have plots of an area not less than 0.25-2 ha (depending on the crop) in order to mechanize the work. As yet, for a large mechanized farm there are no sufficiently well-grounded methodical directions on the best sizes of experimental plots.

The most efficient allocation of plots, at which it would be possible to cover, to a maximum, the full variegation of conditions of the environment by each variant, and, first of all, the variegation of the soil fertility, appears to be an important factor. In multistage allocation of variants of the experiment, especially on leveled, uniform sections, this is provided by the checkerboard [shakhmatnyi] method. On variegated sections (according to their soil fertility) the checkerboard method requires, for high accuracy of the experiment, an increase of the plot area [Begin p.39] and of the number of replications. In these cases the use of the paired percentage method, with a smaller number of applications would be appropriate in order to obtain reliable data (of great comparability) and which will permit a simplified treatment of the numerical data. In a field experiment, regardless of the method used, the chief attention must be paid to the observance of high agrotechnique (cultivation of soil, planting, care, harvesting, and so on).

Conducting field experiments on a low level of agrotechnics will not permit the researcher to obtain correct conclusions. Such experiments must not be taken into account.

Replication of variants in the experiment must be compulsory. The increase of the number of replications is more effective than the raising of the size of plots for a greater accuracy of the experiment. With a minor complexness of the soil covering of the plot, which was levelled in respect to microrelief, on plots of a size of 50-100 sq. m, it is possible to lay out the experiment with a smaller number of replications (4-5);* in the presence of great variegation of the field (a heterogeneous microrelief) the number of replications must be increased. Under industrial conditions, with the size of the experimental plot of 1-2 ha good results are obtained from a twofold replication during favorable years; 3, 4, 5 and even 6 replications per 1 ha are insufficient on a variegated background during unfavorable years. Taking into consideration the complexity of conducting field experiments under industrial conditions, especially of sowing and harvesting, and sometimes also the absence of sufficient experience of the experimenter, it is possible to recommend a threefold replication in the presence of sufficient size of experimental plots; but with a twofold replication and when according to replications, the difference

*two - 3 replications for the paired method.

in the yield of variants is great, the experimenter finds himself then in a difficult situation. One can permit a twofold replication in the limits of a field which is homogeneous in fertility. Of course, the computation of the yield, according to variants, including the control, must be conducted on areas of similar size and at a high level of agrotechnique.

Industrial experiment appears to be an obligatory, deciding link in the research of the agricultural technician, plant breeder, tester of machines, and others. Sometimes it is hard to make a correct industrial evaluation of varieties (for instance with a sharply differing shattering of grains or resistance to lodging) in small plot experiments on variety tests even with careful harvesting and threshing. Experiments, conducted under production conditions, will help to gain an understanding of this matter. Besides this, the industrial experiment will permit making an accurate production and economic evaluation of new, more effective agricultural methods, crops and prospective varieties. Such experiments must be conducted in kolkhozes and sovkhoezes applying high agrotechnical methods. Unbroken harvesting of each plot of the experiment is considered to be the basic measure for computation of the yield in both the industrial experiments, as well as under conditions of experimental establishments. Expediency in the use of one or another means of computation of the yield is conditioned by many causes. In experimental institutions, as an exception, during the rainy weather, the calculation of the yield can be per-

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mitted by evaluation of two test sheaves or by isolation of sections.

Independent of the fact, which method (checkered or paired) was used by the researcher in the experiments, the analysis of data must be conducted according to the type of the year (dry, medium or moist). This produces a much better comparability of the data's averages. Quite often, in experiments of many years standing, data according to 3-4 typical years permit understanding the results of the experiment much better and make correct conclusions, than data on a large number of atypical, extreme years.

It is necessary determinedly to condemn the tendency in individual cases to make the agriculturally poor quality experiments seem to be sound with the aid of mathematics. Each mathematical processing of experimental data, [Begin p.40] by any method, must be preceded by the most careful agricultural analysis. The researcher must know positively in all cases that the experiment was conducted under conditions of the most favorable agrotechnique, with a sufficient size of plots and number of replications, that there were no substantial violations of methods and technique. Without entering into detailed discussion of different opinions on the importance of mathematics in the agricultural experimental work, one can mention, that mathematics (biometric methods of research are meant here) is needed and useful. It is necessary intelligently to strive for applying mathematics in the experimental work. Unfortunately, agriculturists often do not have sufficient mathema-

tical training, and the mathematicians do not know the agricultural science, as a result of this some of them approach the biological problem from the narrow mathematical point of view, and the others cannot use the biometrical methods of research with sufficient fullness and qualification.

Experiments, in which one is supposed to obtain serious, large increases of yields, according to variants (for example, in experiments with effective fertilizers, with prospective kinds of soil cultivation, and some others), can be conducted with an accuracy of the experiment not only in the limits of 5%, but also a lesser one. On the contrary, in the experiments where the researcher must detect delicate, insignificant differences between the compared variants, higher demands must be made.

We, of course, do not deny that the average (m) errors of mean values (M) of the accuracy of the experiment (P) and the coefficient of authenticity (t), and others are the important statistical indices, and there, where it is necessary, they must be determined.

In England, USA, and other countries great importance is attached to problems of utilizing mathematics in the analysis of data of biological experiments. Scientists of Bulgaria, Poland and other countries write about this important side of biological research. Professor "Gencho Genchev" (Bulgaria) in his work "Importance of the mathematical method and of statistical regularities in biology and agriculture" makes an attempt of proving the necessity of mathe-

mathematical analysis of experimental data. He does not share the idealistic opinion of the role and importance of mathematical probability in natural science. But he asserts that "wide introduction of any measure in agriculture can be recommended in that case when its positive economic effect will be proved as a regular, but not an occasional, phenomenon by means of carefully tested experiments and correct and objective interpretation of the obtained data by way of application of a mathematical method".

We fully agree with the correct thesis of the Bulgarian scientist, that good results can be obtained only in the combination of good experiments with good mathematical elaboration of obtained data. Unfortunately, in many experimental establishments of USSR the statistical methods of elaboration of experimental data are ignored the most often, or are utilized obviously insufficiently.

Authors of articles, published in journals "Zemledelie" [Agriculture] "Nauka i Peredovoi Opyt v Sel'skom Khoziaistve" [Science and Leading Experience in Agriculture], and others not only do not cite any indices of mathematical analysis of data, but in many cases even do not write about conditions and method of conducting the experiment.

The accompanying calculations and observations in the program of the experiment are of important value. They help in detecting the interconnection of the environment with the studied phenomena, in interpreting correctly the obtained results of the experiment. Under-estimation of the importance of this research, absence of necessary computations [Begin p.41] hamper the possibility of.

making sufficiently well-grounded conclusions and lead to a rejection of the experiment.

The problem of selection of the experimental plant merits attention, in particular, in agrotechnical experiments. It is known, that reactions of varieties to different conditions and agricultural methods (fluctuations of meteorological elements, cultivation of soil, fertilizers and others) vary greatly; this is connected with the biological characteristics of varieties. Especially changeable is the behavior of varieties and forms, that are not adjusted to ecological and industrial conditions. An agricultural ecotype must serve as the experimental plant.

Branch and zonal scientific-research institutes, which are entrusted with the scientific-methodical leadership in the entire experimental network, must pay more attention to problems of methods, carefully to analyze defects in the work of experimental stations and not permit gross violations of methods of the field experiment.

The All-Union Agricultural Academy imeni V. I. Lenin, as the leading scientific-methodical center, must take measures for a deciding improvement of agricultural experimental work in scientific-research institutions. It is necessary to foresee, in the thematic plans of the institutes, the theoretical and practical problems, connected with the improvement of methods and technique of field experiments, both under conditions of experimental institutions, as well as of the production.

Taking into consideration the ever growing development of agricultural experimental work in our country and the increasing requirement in trained cadres of experimenters, it is necessary to introduce a special course of methods of experimental work in agricultural higher institutes of learning ["vuzy"]. It is quite expedient to have independent Chairs in individual large agricultural higher institutes of learning after the example of the Moscow Agricultural Academy imeni K. A. Timirlazev. The student must be well trained methodically for his subsequent agricultural activity.

It is beyond doubt, that an agriculturist, regardless of the fact if he is working in an experimental institution, at a kolkhoz or sovkhos, cannot dispense with the conducting of field experiments in his industrial activity, and, consequently, do also without solid and deep knowledge of methods of the field experiment.

We consider that the necessity has matured for the publication of a series of fundamental educational and practical handbooks on the problems of methods of the experimental work.

Andreev, S. V., Martens, B. K.,
Stepanov, A. S., and Trushinskii, A. N.

Kamera iskusstvennogo klimata dlia issledovanii
v oblasti zashchity rastenii

[A chamber of artificial climate for research
in the field of plant protection]

Zashchita Rastenii ot Vreditel'ei i Boleznii,
vol. 4, no. 6, p.17-18. Nov/Dec. 1959. 421 Z1

(In Russian)

This set-up was developed and produced in the Biophysics Laboratory of VIZR [All-Union Scientific Research Institute for the Protection of Plants]; it consists of: 1) a phytotron - a chamber in which are placed the experimental and other objects of research and in which are installed special sources of light and semi-conductor transmitting elements of the regulating apparatus, 2) conditioner - units for artificial production of required climatic conditions, 3) water supply devices and 4) the control panel. The volumetric capacity of the chamber is 15 m³. Racks are also provided for placing experimental plants, mesh isolators with insects, and so on, as well as a soil incubator for observation of plants, of soil-inhabiting insects and microorganisms at a different temperature of the soil.

Along the walls of the chamber, at the top and at the bottom, are two P-shaped air pipes, which are connected to the conditioner. The air is fed along the upper pipe, and returns to the conditioner along the bottom pipe as carbon dioxide accumulates in it.

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In this manner the necessary climatic conditions are produced and upheld in the chamber. A vestibule is constructed in front of its entrance; a water system faucet and a sink are provided there, as well as bactericidal lamps for disinfecting the clothing of those working with pathogens of infectious diseases of plants.

The chamber is lighted with the aid of a set of lamps equipped with mirror reflectors; luminescent ones and a spot mercury arc-quartz lamp of extra-high pressure, producing a spectrum of ultra-violet radiation in a wide range of wave lengths. A water filter was constructed for the absorption of infra-red thermal radiation, producing a harmful effect on plants.

Such a combined illumination of the chamber was produced with the aim to approximate daylight to the maximum degree in its spectrum composition.

The ceiling of the chamber is made of glass. The walls are made in the form of panels, that are fastened to a dismountable metal structural frame.

The air, entering the phytotron, receives the necessary moisture and temperature in the conditioner, inside which are mounted: the evaporator of the refrigerating machine for air cooling, the fan, the air humidifier, two electric heaters of air, that moves through the conditioner, and of water, which enters the atomizer of the humidifier. Regulation of temperature and humidity is attained by means of separate switching in or off of the above cited devices.

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The humidity of air can be regulated by the change of temperature of water, which is fed to the sprayers.

Switching in and stopping of the refrigerating machine, of electric heaters, of the fan [Begin p.18] of the pumps are produced from the control panel, which has a button mechanism. Here too are installed the control-measuring apparatuses, with the aid of which it is possible to conduct the measuring of climatic parameters inside the chamber, as well as automatic regulation and upkeep of the assigned regimes.

The layout of these apparatuses, based on the use of semiconductor thermal resistances, was also developed by the Biophysics Laboratory of VIZR. M. A. Bergfel'd also took part in the production of the phytotron, besides the authors.

Title of the pictures. Chamber of artificial climate: 1) general view of the phytotron. 2) Interior view. 3) Control panel. 4) Glass ceiling of the chamber, over which are placed the reflecting incandescent lamps. 5) Three-chamber humidifier of the conditioner with the atomizers. Photograph by V. A. Tsin.

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Kalashnikov, A. I.¹, Samoletov, A. I.,
Salgannik, M. G., and Kostin, I. G.

Opyt ispol'zovaniia malykh doz radioaktivnykh
izlucheni pri inkubatsii

[Experiment with small doses of radioactive
radiation in the incubation of chicks]

Vestnik Sel'skokhoziaistvennoi Nauki, vol. 4,
no. 8, p.47-50. Aug. 1959. 20 V633

(In Russian)

The use of radioactive radiation as a biological stimulant in the incubation of eggs of agricultural fowl is an entirely new business. It is known that certain scientific establishments have tried to investigate the influence of radioactive radiation upon incubation eggs, but in these attempts the production percentage of healthy chicks proved lower than that of control (unexposed) groups. The cause of this failure is clear to us: the doses of radioactive radiation applied by different laboratories were too high and they had been used at random without any theoretical calculations.

In our investigations, we took into consideration the fact that radioactive radiation occurs in nature and, consequently, is a factor of external environment. Gamma rays that represent rigid electromagnetic waves and possess great energy and high penetration power are of specially great importance. Gamma rays are a

¹ Director of the Tomilino Poultry farm

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necessary condition in the life of any living organism. Hence we refute the opinion that natural ionizing radiation is harmful for an organism. Agricultural practice utilizes effectively not only the electromagnetic waves of day light, but also infrared (heat) and ultra-violet rays the beneficial influence of which upon a living organism is beyond any doubt at the present time.

As a basis for our calculations, we used the magnitude of natural radiation (equalling approximately 0.0003 roentgens within 24 hours, or 0.0000002 roentgens per minute) which we adopted as a unit and provisionally called KR (cosmic radiation).

Further we were confronted by the essential problem as to the exact time in the development of an embryo in which supplementary ionizing radiation can be utilized as a stimulating factor and in what doses. At the very beginning, we assumed that the embryo undergoes a more intensive development after every 3 days of the incubation [period] (beginning with the day the eggs are placed in the incubator) and, proceeding from this circumstance, we established the days of the incubation [period] on which irradiation was to be conducted (1,3,6,9,12,15 and 18th day of the incubation).

Irradiation was carried out with the aid of uranium and thorium salts that produce a soft gamma-radiation. During the [treatment] session, a container with isotopes was put into an incubator, or the eggs to be exposed were taken in their boxes [lotok] (at the same time as controls) into one of the rooms of the incubation

building. A notable, positive effect [begin p.48] was first obtained from a dose of 0.00002 roentgens per minute when exposed to a 10 minute treatment. The best results were observed when [eggs were] exposed to a dose of 0.0001 roentgens per minute directly in the incubator and when exposed to a dose of 0.0002 roentgens per minute in a room of the incubation building. We determined the hatching results by the number of fertilized eggs which we obtained from one chicken coop with an identical collection.

The experiment conducted in December 1956 (at an exposure of 360 eggs outside the incubator) demonstrated that the batch of healthy chicks hatched from the control group comprised 90.4%, from the group irradiated with a dose of 0.014 roentgens - 92.8%, and from a group irradiated with a dose of 0.021 roentgens - 97.5%. During the following three experiments irradiation was carried out directly in the incubator that contained 720 eggs (the control boxes contained 360 eggs). As a result the batch of healthy chicks in the control groups equalled 89.6%, when irradiated with a dose 0.014 roentgens - 96.6% and with a dose of 0.021 roentgens - 94.3%. Both methods used in irradiating eggs (directly in the incubator and outside of it) have demonstrated the presence of a stimulating factor.

Further, we defined more precisely the size of the dosage and the duration of exposure in experiments which we conducted outside the incubator. In 1957, we irradiated eggs in one, two, four, seven and nine replications for 10 minutes each [za odin seans].

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A total of over 10 thousand eggs were exposed to radioactive radiation. All variations of the experiment produced a positive effect. The best results were, however, achieved in a seven replication irradiation with a dose of 0.0002-0.0003 roentgens per minute. During a one-time ten-minute irradiation, the embryos received altogether 0.002 roentgens, that is, approximately as much as from natural radiation within seven days. Such radioactive action produced a notable positive effect: [the yield] obtained from 1222 irradiated, fertilized eggs comprised 95% of healthy chicks, yet in control groups (1218 eggs), with all other conditions being equal, the brood comprised 87.2%, that is 7.8% less

In 1958, different variations were used in experiments, including changes of chicken coops and seasons of the year. The most effective one proved to be the same method of irradiation: 0.0003 roentgens per minute, or 0.021 roentgens for the whole incubation period. There was scarcely any difference between the irradiation dosages which we used and the doses of natural radiation. This fact eliminated [our] misgivings regarding the injuriousness of these dosages in ontogeny and in phylogeny. Observations of the development, egg production and reproduction of chickens that had been exposed to radioactive irradiation during the period of embryonic development confirmed this fact. Radioactive doses that influence a living organism and are used in institutes and laboratories (they are expressed in hundreds, thousands and even more roentgens, and severely disturb metabolism, cause destruction

the fourth day) and the nineteenth day. The greatest effect was produced by irradiation on the nineteenth day ^{one day before} ~~the last day~~ of incubation when the embryo transfers from allantoic oxygen nutrition to air respiration. It is assumed that in irradiation during this period there occurs a partial decomposition of water molecules that are found in the air enclosing space [puga] at one end of an egg and that there forms molecular oxygen that can serve as supplementary food for the embryo. Experiments with single irradiations have demonstrated that radioactive (even one replication) influence exerted on a specific day of the incubation period can prove sufficient to increase the brood of chicks 5%, that is, to obtain approximately the same effect that one does in a seven replication irradiation. This fact can be explained by the circumstance that the after effect of the penetrating radiation can be connected with the initiation [in'itsirovanie] factor which is in complete accord with Academician N. N. Semenov's theory concerning chemical kinetics, although this hypothesis still requires profound supplementary testing. Consequently, a single irradiation can produce the same results as a multiple one. Experience has demonstrated that a seven replication irradiation, with all other conditions being equal, guarantees more stable, favorable results.

At the end of 1958, we conducted a series of experiments in continuous irradiation of embryos; for this purpose we placed the irradiation source in the incubator beneath the brooders [lotki] for the entire incubation period. For the 20 days of incubation

each embryo received 0.6 roentgens, that is, 300 times more than in intermittent irradiation. The positive result obtained in this case scarcely differed from the effect obtained in intermittent irradiation.

Lately, we developed a method whereby eggs are irradiated in the first days of the incubation (5-6 days) and on the nineteenth day. In experiments conducted by this method, the indicators obtained of the brood according to breed were as follows: New Hampshire [N'iu-gempshir] - 80.5% of the eggs placed (in the incubator) [zalozhennye] and 92% of those [that were] fertilized; controls 71.7% and 85.6% respectively; Leghorns - 89.8% of those set and 94.4% of fertilized eggs; controls 84% and 90.2% respectively. In this case, too, the result was approximately the same as in intermittent radiation, but in more prolonged irradiation the effect seemed to become fixed and more promising.

It must be noted that in the event high grade eggs are incubated, then the irradiation effect is not particularly considerable - the brood is increased by no more than 5-7%. Stimulation is considerably more effective in cases in which the eggs delivered for incubation are of a somewhat lower grade. On December 21, 1956, for example, 116 eggs each in the experimental and the control group were placed in an incubator. In controls, the ratio between the brood hatched and [the eggs] placed for hatching comprised 77.5%, and the ratio of those fertilized was 84.9%; in the experimental group it was 92.3% and 97.2% respec-

tively; on August 18, 1957, 120 eggs each were laid [to hatch] in an experimental and a control group, the brood of the control group comprised 83.4% of the [eggs] laid to hatch, and 88.5% of the fertilized [eggs]; in the experimental group it was 92.5% and 97.3% respectively. On December 11, 1957, out of 120 eggs laid to hatch, the brood of each group among controls [Begin p.50] comprised 79.1% of those laid to hatch and 92.2% of those fertilized; In the experimental group the brood equalled 90.8% of [the eggs] laid to hatch, and 98% of those fertilized. On January 18, 1958, after 120 eggs were placed in each group, in controls 80% were obtained of the eggs laid to hatch and 83.5% of those fertilized, and in the experimental group it was 88.3% and 96.3% respectively.

Observation of the subsequent development of irradiated chicks demonstrated that the fowl developed normally and that its egg production and ability for reproduction was somewhat higher in irradiated chickens than in nonirradiated ones.

Within two years, the radiobiological laboratory of the Tomilino poultry farm conducted 120 experiments and exposed a total of about 50 thousand eggs to radioactive radiation during the incubation period. In some experiments stimulation was small (2-3%), but the brood of chicks in experimental groups was in no case smaller than that in controls.

In our experiments the lowest threshold of penetrating radiation energy has been established at 0.0002 roentgens, after which there begins a notable stimulating influence of irradiation. This

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dose can be recognized as the minimal concentration of the energy activation element. The upper radiation threshold beyond which depression phenomena can be observed can be found within the limits of 20 roentgen. A dose of 26 roentgens produced an increase in the number of chicks that suffocated within the egg and reduced the total brood to 90.5% (among controls the brood equalled 92.4%). In the same incubator with a dose of 2.1 roentgen, the brood comprised 94%, that is, 1.6% higher than in controls. Thus, the range of useful radioactive influence proves to be very wide - from 0.0002 roentgens to 20 roentgens. In order to establish an optimal regime it will be necessary to conduct new experiments in combination with other factors: heat, humidity, oxygen exchange etc. The data that we obtained permit in part utilizing radioactive ^rirradiation in production practice, as well as in selection.

In future, the postembryonic development, the production and reproduction ability of hens that have acquired the radioactive impulse during the embryonic stage will have to be tested on considerable numbers of fowl. For this purpose, a big batch of eggs has been placed in an incubator at the Tomilino chicken farm.

[English, German and French summaries
are on page 50]

Galeev, G. S.

Metod polucheniia mezhlinceinykh gibridov so
steril'noi pyl'tsot materinskikh form

[Method of obtaining interlinear hybrids
of maize by using the sterile pollen of
female forms]

Vestnik Sel'skokhoziaistvennoi Nauki, vol. 4,
no. 6, p.43-54. June, 1959. 20 V633

(In Russian)

Utilization of heterosis is a powerful means for increasing productiveness of agricultural plants and especially of such that submit themselves to hybridization comparatively easily. As it is known, corn belongs to the number of such crops. Its dioeciousness and spacing of male inflorescences, which is convenient for emasculation, permit to conduct a controllable crossing on hundreds and thousands of hectares. One man can emasculate 5,000 plants during an eight-hour workday without particular exertion. Additional expenses for the production of hybrid seeds, which, usually, under conditions of the Krasnodar krai comprise 8-12 man-days per 1 ha of hybridization section pay well for themselves, since the hybrids, especially the interlinear, considerably surpass the ordinary varieties and hybrid populations. The effect of heterosis in interlinear hybrids is 3 times higher than in intervarietal.

Kubanskaya Opytnaya Stantsiya Vsesoiuznogo Instituta Rastenievodstva
[Kuban Experimental Station of the All-Union Institute of Plant Industry]

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An unfailing condition for obtaining high yields of hybrid seeds is the 100-percent pollination of plants of the female form by the male; this can be attained only by a timely (before blooming) removal of all inflorescences from plants of the maternal form. Nevertheless, removal of tassels under production conditions is not conducted altogether perfectly. Thus, during the course of the last four years on many varietal plots of the Krasnodar krai comparative studies of the yielding capacity of hybrid seeds were conducted; they were grown in kolkhozes and at the Kuban Experimental Station of VIR [All-Union Institute of Plant Industry]. Results of these studies show that the yielding capacity of seeds of the hybrid VIR 42, grown at the kolkhozes, is lower by 2.8 c per 1 ha on the average, than the seeds, grown at the Kuban Experimental Station, where a careful removal of tassels was conducted (table 1).

Table 1

Yielding capacity of corn seeds, grown in kolkhozes and at the Kuban Experimental Station (c/ha)			
Year	Number of experiments	Yield of seeds of hybrid VIR 42 in planting with seeds	
		at the station	In the kolkhoz
1955	8	48.1	44.6
1956	32	57.5	53.0
1957	11	26.9	25.6
1958	5	67.2	65.1
Average	56	49.9	47.1

The blooming of corn coincides with the most strenuous period of agricultural works - the harvest of grain crops.

And the process of detasseling cannot be mechanized in any way*, [Begin p.44] and in the presence of large areas of hybridization sections on the farms a great number of people are occupied with detasseling. All this compels, in the search of more improved methods of hybridization, to turn to the plant proper, particularly, to the utilization of the characteristic of pollen sterility, which was given the name of cytoplasmic male sterility.

The male sterility, transferred along the female line (through the plasm) was yet discovered in 1931 by the Soviet scientist M. Khadzhinov, and, independently of him, was described by the American, M. Rhodes. But the practical utilization of the male sterility refers to a much later time. N. Jones and N. Everett, in 1949, suggested the use of lines with cytoplasmic male sterility for obtaining hybrids without the removal of tassels. They gave a description of the main peculiarities of this method. It was experimentally established by works of various scientists, that cytoplasmic male sterility can be introduced to the hereditary type of the required line by means of reverse repeated (saturating) crossings and selection. Such lines can serve as female plants for obtaining simple hybrids with male sterility, and the latter - as female forms of double hybrids; the male line of the female simple hybrid must retain male sterility in the descendants, while

*A certain raising of the productiveness of labor can be attained only through a mechanical transportation of the workers along the rows (use of a power-driven cart).

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the remaining two lines of the double hybrid - the parental forms of the male simple hybrid, on the contrary, must reestablish the fertility (fruitfulness) of the hybrid.

The presence of two such types of lines, which determine either the fertility or sterility, permits to use such a scheme of production of hybrid seeds, which fully or partly excludes the necessity of emasculation (removal of inflorescences) of female plants.

At the present time in USA two types of cytoplasmic sterility - Texas and "Aldshep" [IoJap] are used for the production of hybrid seeds. The Texas type is the most widely distributed; most of the lines prove to be fixers in respect to it. There are lines, which exclude this type of sterility; that is, they restore fertility. The presence of two types of lines, which determine the sterility or which restore the fertility, makes this type of sterility the most valuable for the selection. A preliminary cultivation of two similar double hybrids is required, one - fully fertile, and another - sterile for the industrial utilization of sterility of the IoJap type. The fertile analogue, blended with the sterile, provides the necessary fertility of the plantings.

In the Soviet Union, along with the Texas type of sterility, the Moldavian type is also widespread; it received its name from the corn variety Moldavian yellow ("Bessarabka") and the Moldavian orange. The first crossings, which started the practical use of this type of sterility, were conducted by us at the Kuban Experimental Station of VIR in 1953.

The plants, which differ in the type of sterility, react differently to the pollination with the pollen of one and the same line. For instance, in pollinating a plant with the Texas type of sterility by the line A34, it retains the male sterility in the offspring stably, while a plant with the Moldavian type restores fertility in the descendants. These types differ also in the outward appearance of tassels: in plants with the Texas type the degree of sterility is much higher, the anthers degenerate stronger, they very rarely protrude from the spikelets and never open up, that is ^e never spread any pollen; in the Moldavian type the anthers often protrude from spikelets and often contain a small amount of pollen with germinating power, but they do not open up; owing to this fact the tassel continues to remain sterile. The degree [Begin p.45] of sterility changes somewhat depending on the place and condition of growing the plant.

Classification of lines, according to their reaction to different types of male sterility. Numerous crossings, in which plants with sterile male inflorescences were used as female forms, have shown, that in the World Collection of VIR [All-Union Institute of Plant Industry] there are lines which are suitable for the production of both the female forms with sterile pollen, as well as the male forms, restorers of hybrid fertility. Each source of sterility was studied separately; the reaction of lines was tested separately in regard to Texas and Moldavian types of sterility. Degree of fertility was evaluated according to the 7-point scale: blooming of tassels proceeds normally, a lot of pollen is formed (6 points); single male flowers are sterile (5 points); up to 50%

of flowers are normally developed, form a great deal of pollen (4 points); tassel almost fully sterile, only single anthers discharge pollen (3 points); tassel is sterile, a small amount of pollen forms in anthers, it is mostly underdeveloped, in blooming the anthers protrude from anthers but do not spread pollen (2 points); sterility is expressed still stronger, during blooming only single anthers protrude from spikelets, but they always remain closed (1 point); full sterility - anthers degenerated strongly, do not contain any pollen with germinating power and never protrude from spikelets (0).

Plants, appraised at 5-6 points, form the fertile class, at 3-4 points the semi-sterile, at 0-1-2 points the sterile class. Besides that, the special condition of tassels, in which the anthers, remaining sterile, never leave the spikelets, but contain a small amount of pollen, was appraised at a point 01. Sterility of the Moldavian type was appraised at points 01, 1 and 2, and the Texas - at only 0 and 01, and very rarely 1.

The studied lines, in respect to the Texas type of sterility, were assigned to three following groups.

1. Fixers (in crossings with sterile plants dependably retain the male sterility in the descendants) no. D203, no. D230, no. D255, no. D273, A15, A21, A34, A39, A73, A111, A116, A131, A158, A165, A166, A171, A172, 8, 9, 15, 16, 33, 47, 49, 374, C14, C42, L, P, R3, WF9, M13, OS420, L289, CN, B28, C-1-29, C-6-29, 38-11,

187-2, Cr-30, G-380, J-22.

2. Restorers of fertility (excluding male sterility in descendants): 24, 28, 1-153, LR, W155R, A344R, W153R, UW5, S1325, SV19, SM-1, VK, K-1-1 and K.

3. Semi-restorers (intermediate between the two first groups); M14, it1 701, Oh28, 25, 62, 206, A71, ND283.

The remaining lines, studied by us, produced single fertile plants in the pollination of sterile plants of the Texas type.

As it is seen from the cited data, there is a sufficient number of line fixers in the VIR collection, and very few restorer lines. There are comparatively many of them only among the Argentine lines (50% of studied Argentine lines proved to be good restorers). These lines are: UW5, S1325, SV19, SM-1, VK and K-1-1.

But the Argentine lines have a long growing season, and therefore are unsuitable for direct use in medium-ripening hybrids; lines 1-153, 153 and A344 virtually differ very little from each other, and, apparently are analogues. Lines 24R, W155R and LR were not yet sufficiently studied.

Lines with the Moldavian type of sterility are more difficult in utilizing for the purpose of selection. Extent of manifestation of this type depends to a greater degree [Begin p.46] than the Texas type on conditions of the environment. This type of sterility is retained more or less satisfactorily by the following

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lines: A, A21, A31, A42, A73, A114, A131, A148, A155, A158, A165, A166, A334, A344, A357, A374, A375, A392, 15, 17, 22, 28, 49, 85, 90, 187, Oh51, M13, L, OS420, WF9, M14, NU, 38-11, OS426, L317, W22, Cr30, Cr36, 4226, C-6-29, ND203, ND283.

There are still fewer restorer lines for the Moldavian type of sterility than for the Texas. To their number can be referred A34, A116, A71, A171 and partially - A111, A340, A347, 8, 9, 16 and 23.

The characteristic of lines of regionalized and prospective VIR hybrids is cited separately (table 2) in respect to both types of sterility.

Table 2

Reaction of self-pollinated lines of regionalized and prospective corn hybrids of VIR in hybrids with Texas and Moldavian types of cytoplasmic male sterility (according to data of Kuban Experimental Station of VIR and of Krasnodar Scientific-Research Institute of Agriculture, in 1958)

Pollinizer lines	Fertility (sterility) of the hybrid in using it as a female form of plants with sterility		Pollinizer lines	Fertility (sterility) of the hybrid in using it as a female form of plants with male sterility	
	Texas type	Moldavian type		Texas type	Moldavian type
VIR 11	S	SF	VIR 53	S	S
VIR 20	S	F	VIR 55	S	S
VIR 26	S	F	VIR 60	SF	F
VIR 27	S	FS	VIR 64	S	S
VIR 28	S	S	VIR 75	S	SF
VIR 29	S	SF	VIR 82	S	F
VIR 38	S	S	VIR 93	S	SF
VIR 39	SF	SF	VIR 100	S	S
VIR 40	S	S	VIR 109	F	S
VIR 41	S	S	VIR 115	F	S
VIR 43	S	SF	VIR 116	S	SF
VIR 44	F	S	VIR 118	S	S
VIR 47	S	FS	VIR 133	S	S
VIR 51	S	S	VIR 157	SF	S
VIR 52	S	S	VIR 158	S	S

(Footnote for table is on next page).

Footnote. Conventional signs of hybrid plants: "S" - sterile, "F" - fertile, "SF" - semi-sterile with a predominance of sterile plants, "FS" - semi-sterile with a predominance of fertile plants; lines of the indicator of sterility are marked out by underlining.

In 1958, necessary crossings were conducted for the purpose of drawing up a characteristic of the entire collection of self-pollinated lines. The existing data can be used in the work of production of double hybrids, whose tassels need not be removed during growing of hybrid seeds.

Cultivation of sterile analogues of the lines. Work of production of sterile analogues (duplicates) is conducted with lines that retain the male sterility well in the descendants, using the method of reverse saturating crossings (figure 1). Any varieties, hybrids and lines, which possess sterility to a high degree (point O and O1), as well as the female type of inheritance of this sterility are suitable as a source of sterility. Three to 5 specimens are pollinated with pollen of the selected line, into which it is intended [Begin p.47] to introduce the sterile plasm; simultaneously with this, the plants of lines, which were used as pollinizers, are self-pollinated. The next year a repeated pollination of sterile plants of the hybrid of the same line is conducted; at the same time a hybrid family, which showed the greatest degree of sterility is used as the female; while as the male - the descendants of that self-pollinated plant of the line, which was the pollinizer in the obtaining of the given hybrid. During the third year this process

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is again repeated, but when selecting female families and plants one takes into consideration not only the degree of sterility of tassels, but also the analogy of these families and plants with the line taken. Such saturating crossings and selection are continued until that time when the hybrid becomes, in its external appearance of the plant and ear, so close to the line that, virtually, it is impossible to distinguish them. Nevertheless, the obtained form differs from the line by the sterile form of the tassel and, therefore, is called the sterile analogue of the given line. It is obtained after 5-6 generations of saturating crossings. Use of crossings on a large scale (especially during the last stages of saturation), together with a directed selection, reduces this time to 4, and sometimes even to 3 years. Ears of different generations, saturated with lines VIR 27, VIR 100, VIR 53 and VIR 64 are depicted in figure 2.



Title of figure 1. Diagram for obtaining a sterile analogue of a corn line.

Words in figure 1. Top line: Generations. Saturating crossings. Bottom line: Reproduction. Under the figure.

Conventional symbols:

ETS - plant, possessing male sterility of Texas type

A - fertile self-pollinated line

ATs - sterile analogue of line A

Certain sterile analogues of the third generation of the saturation were tested in special crossings, which confirmed that the analogues are the same in hereditary respect. Thus, for instance, in the preliminary test, in 1958, the simple hybrid with male sterility F_1 (44 ms X38) ms yielded 70.9 c per 1 ha, and its fertile analogue - F_1 (44X38)-71.9 c, that is both harvests were virtually similar. The sterile analogue of the line was kept up in reproduction with the aid of its fertile analogue, which took part also in the saturating crossings. Thus, an improvement of the original lines as fixers is conducted simultaneously with the reproduction of sterile analogues.

In those cases when no sterile analogues are produced for the fixer lines, and they are utilized in the female simple hybrid as a male form, the work of their improvement by the above cited method is carried out specifically. But in these cases the saturating crossings are limited to one generation. Such a work was conducted at the Station with the lines VIR 38, VIR 29, VIR 11, and others for their utilization in crossings with the sterile analogue of the line VIR 44.

As it already has been pointed out above, there are very few restorer lines in the VIR collection. Meanwhile their number should not be smaller than that of the fixers; in a double hybrid one or two lines, out of four, must have [Begin p.48] a restorative ability. This problem can be solved by producing new fixer lines and analogues restorers for prospective lines, which are restorers (by nature).

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Title of figure 2. Generations of saturating crossings with the participation of the line a) VIR 27 (pollinizer); b) VIR 100 (pollinizer); c) VIR 53 (pollinizer); d) VIR 64 (pollinizer).

Words in figure 2. Top line: a; original; b; original.
Second line: Generations: 1, 2, 3, 4. Generations:
1, 2, 3, 4. Third line: c; original; d, original.
Fourth line: Generations: 1, 2, 3, 4. Generations:
1, 2, 3, 4.

Use of cytoplasmic male sterility in new lines.

In growing new lines at the Kuban Experimental Station, an original method of their evaluation has been applied; it consisted of the following: studies of the reaction of new lines on the male sterility and, consequently, detection of restorers, is conducted beginning with the third generation of self-pollination, when the combination ability of the line is already stabilized. This work coincided with the studies of the combination value of the line. Simple hybrids, possessing male sterility were used as testers (analyzers); owing to this both the reaction to sterility and the combination value of the line are exposed simultaneously.

In this way one can raise a great number of restorer lines in a comparatively short time (5-7 years) provided the initial material includes the factors of restoration of fertility. The worth of this method consists yet in the fact that restorer lines are selected for specific hybrid combination, in which a simple hybrid with male sterility serves as a female form. For outstanding fixer lines the sterile analogues can be produced already beginning with the third generation. These lines, later on, can be included into testers (taking place of the worst line or of both lines), owing to which the quality of testers will be improved, as well as of hybrids with their participation.

Selection of lines by the new method is being conducted at the Station already for the third year and gives good results. Ten new lines of the 5-6 generation with a good restorative ability is intended to be delivered to the collection from the 1959 harvest; sterile analogues are being produced for 5 fixer lines. [Begin p.49]

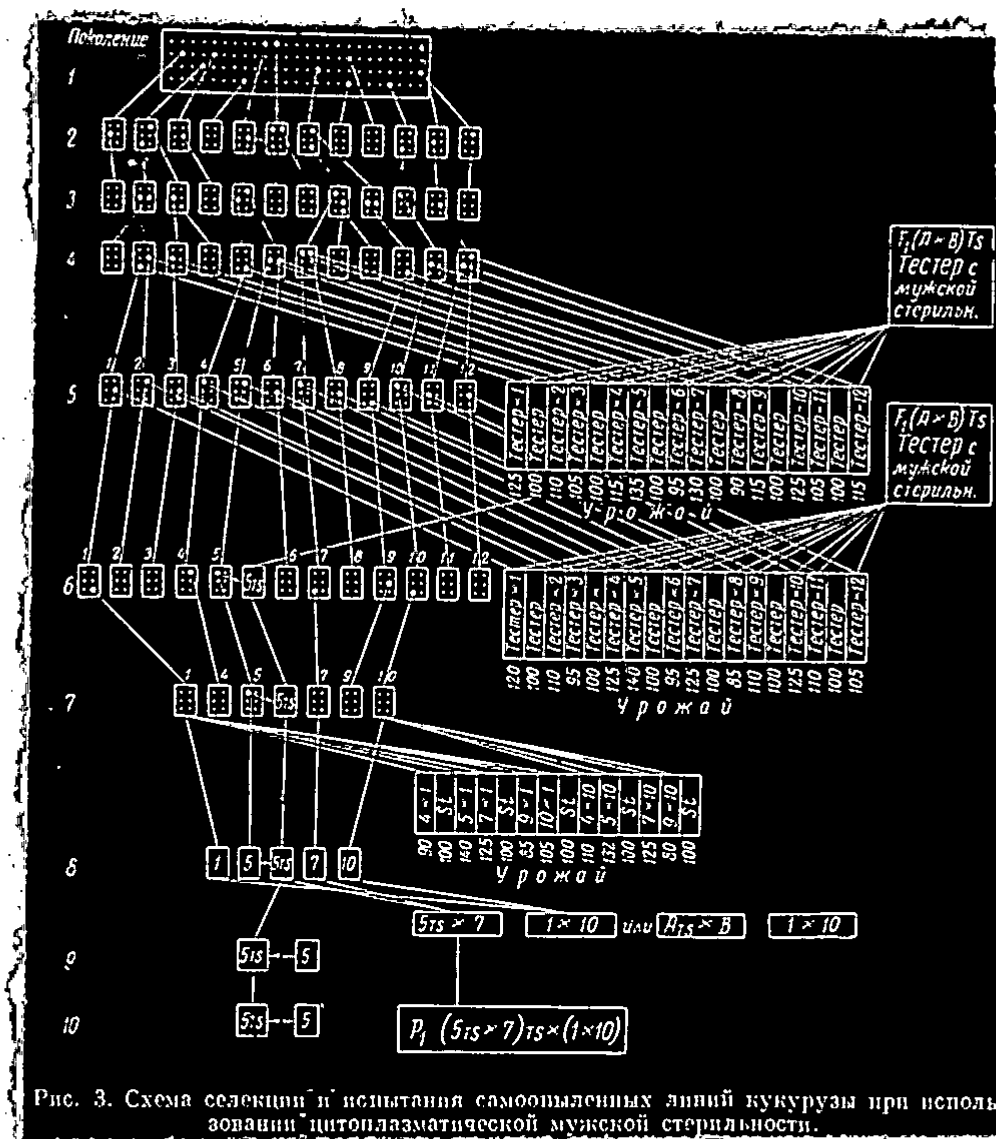


Рис. 3. Схема селекции и испытания самоопыляемых линий кукурузы при использовании цитоплазматической мужской стерильности.

Title of figure 3. Diagram of selection and testing of self-pollinated lines of corn in utilizing cytoplasmic male sterility.

Words in figure 3. Top: generation. In both squares. Tester with male sterility. In both oblong quadrangles the word "tester" is repeated 18 times. Under the quadrangles the word: Harvest. Under the small quadrangle the word: Harvest. Between the two middle small quadrangles the word: or.

That something new, which we introduced to the methods of selection of lines and hybrids, is graphically reflected by the below [sic] cited diagram on raising and testing of new lines of

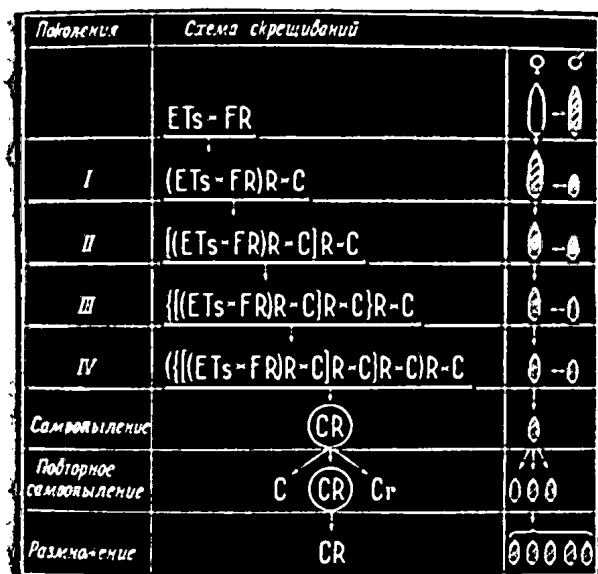
corn, that are utilized in hybrids with sterile pollen of female forms (figure 3). This diagram represents an improved variant of the most widely distributed, at the present time, diagram of selection in testing new lines (look up Rumffeld's "Utilization of the effect of heterosis in the selection of corn". Collection of articles "Gibridnaya kukuruza" [Hybrid corn]. Publisher of foreign literature. Moscow, 1955, p.143). We tried to preserve from the old diagram as much as possible, up to the correlation of forms, in order to show that something new which changes it substantially.

Let us mention one more very important advantage of the new diagram. American specialists think that selection of hybrid corn, basing itself on inbred lines with sterile pollen, requires a much longer period than the usual selection. In order to create a sterile analogue of a line for a hybrid, it is necessary to spend 5-6 [Egin p.50] years, and for obtaining hybrid seeds with the aid of this line and their testing several more years will be required. It is possible to raise a still more fruitful hybrid during this time by the usual methods (on a fertile basis).

Our scheme removes such a lagging in selection, which is conducted on the sterile basis. Lines yet in the process of inbreeding find their place in hybrids. The sterile tester points to this. Sterile analogues are produced for the most outstanding fixer lines in order to use them later on for obtaining more productive testers. In this way the idea of continuity of selection of interlinear hybrids is realized very successfully.

Production of analogue restorers of fertility for prospective lines. Beginning with the year 1957 work is being conducted at the Station on the production of analogue restorers on the basis of the existing lines. Since the year 1958, this work was conducted together with the Krasnodar Scientific-Research Institute of Agriculture according to only one program. Transfer to the lines of the restorative ability is attained by the following method which are varieties of the method of crossing.

The first method (figure 4) is applicable to all fixer lines.



Title of figure 4. Diagram for obtaining an analogue restorer of fertility for the line of corn, which is a fixer of sterility by nature

Words in figure 4. Top line: Generations. Scheme of crossings. 7th line: Self-pollination. 8th line: Repeated self-pollination. 9th line: Reproduction.

Conventional signs:

ETs- plant, having male sterility of the Texas type

Fr - a fertile form, having restorative ability

C - fertile self-pollinated line, that does not have a restorative ability

CR - fertile self-pollinated line, which acquired the restorative ability.

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In the first crossing any plants, varieties, hybrids or lines, which possess cytoplasmic male sterility, are used as the female form, and a restorer line as a male form. In further crossings only restored, normally blooming plants of hybrids participate as the female form, while as a male form the line to which it is supposed to transfer the restorative ability. One or twofold self-pollination of fertile plants is conducted among the most restituted families after the products of saturation practically cannot be distinguished from the pollinizer line.

The analogue-restorer can be obtained also by way of direct crossings. In this case a line is used as the female form, and the restored plants of the hybrid as the male. The necessity in such crossings arises when the blooming of the line is several days in advance of the blooming of plants, intended for use as the female form. [Begin p.51]

The second method (figure 5) is applicable only to lines which already have sterile analogues. It consists of the fact that during the course of all generations only the sterile analogue of the line is used as a female form, while as a male - during the first crossing a restorer (line, hybrid or variety), and further on the restituted plants of the hybrid. Topping off this work are, as in the first method, the self-pollination of restituted plants and selection of the analogue restorer.

Utilizing the sterile analogue, it is possible to "introduce" the restorative ability into the hereditary type of the line by one year earlier.

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Покорение	Схема скрещиваний	♀ ♂
I	ATs ~ FR	0 - 0
II	(ATs ~ FR)R ~ A	0 - 0
III	[(ATs ~ FR)R ~ A]R ~ A	0 - 0
IV	[[ATs ~ FR)R ~ A]R ~ A]R ~ A	0 - 0
Самоблещивание	AR	0
Самоблещивание	A AR Ar	0 0 0
Репродукция	AR	0 0 0 0

Title of figure 5. Diagram of obtaining an analogue restorer for the line of corn with the use of the sterile analogue of this line.

Words in figure 5. Top line: Generations. Scheme of crossings. 6th line: Self-pollination. 7th line: Self-pollination. 8th line: Reproduction.

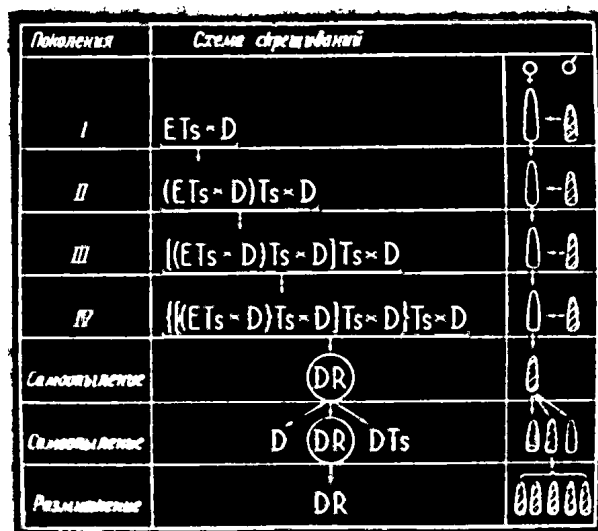
Conventional signs:

ATs - sterile analogue of line A 

A - a self-pollinated line 

FR and AR - fertile lines, having restorative ability  

The third method (figure 6) is applicable to the intermediate group of lines (restoring the fertility only partially).



Title of figure 6. Diagram of obtaining an analogue restorer of fertility of a corn line, which by its nature proves to be a semi-restorer.

Words in figure 6. Top line: Generations. Scheme of crossings. 6th line: Self-pollination. 7th line: Self-pollination. 8th line: Reproduction.

Conventional signs

ETs - a plant having a male sterility of the Texas type

D - a fertile self-pollinated line

DR - an analogue restorer of line D

DTs - the sterile analogue of line D

Saturating crossings were conducted in the same way as in the production of sterile analogues. Sterile plants of the hybrid (of the product of saturation) are utilized in all generations of saturation as female forms, and the line as a male form. The saturating crossings are conducted up to the time when full similarity is attained between the product of saturation and the original line. Peculiarities of the method consist of the fact that the saturated sterile plants are pollinated by the mixture of pollen of the line, and in the last stage of saturation is conducted a one-twofold self-pollination of restored plants; [Begin p.52]

direct crossings are also possible with the use of restituted plants as pollinizers. Another analogue of the line - its sterile form, is produced simultaneously with the cultivation of the analogue restorer. It is necessary to utilize, during the last stage of saturation, not the mixture of pollen, but the pollen from individual plants of the line and self-pollination in order to isolate the sterile form and its fertile fixer. During further cultivation of descendants of saturated plants in individual families it becomes clear which of the participating families of self-pollinated plants of the line are suitable as fixers and as restorers. At the present time the work on transmission of the restorative ability is conducted on 18 prospective lines.

Owing to the use of the above cited methods, sterile analogues with the Texas type of sterility were produced for 8 lines and with the Moldavian type of sterility for 32 lines. Material with the Moldavian type of sterility was obtained from the third generation of saturation in 60 lines. Restorer lines were isolated; several lines with partial restorative ability are being improved. First experimental hybrids with male sterility were produced. One of them (VIR 42 ms), in 1957-1958, was successfully tested on variety test plots of Krasnodar krai, having surpassed its fertile analogue (grown from common seeds with detasseling) in the yield of grain by 1.5 c per 1 ha on the average for 2 years (table 3).

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Table 3

Yielding capacity of hybrid VIR 42 ms (c/ha)

Variety Test Plots	Control (VIR 42 - fertile)	Hybrid VIR 42 ms
Kavkazskii	47.8	50.8
Krasnogvardeiskii	46.1	48.1
Labinskii	55.5	56.9
Severskii	57.1	56.6
Average	51.6	53.1

In 1958, the expediency of utilization of the male sterility in the production of hybrid seeds was confirmed also on the example of other hybrids (table 4).

Table 4

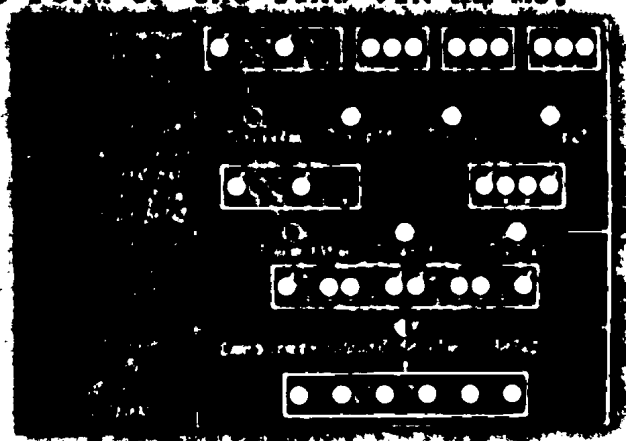
Yielding capacity of new hybrid of the Kuban Experimental Station, which were grown on a sterile female basis (data of the station test in 1958, c/ha)

Hybrid	Yield of grain	Surpassing the yield of the fertile analogue
VIR 313 ms	73.0	+0.3
VIR 327 ms	68.2	+3.9
VIR 344 ms	66.1	+2.6

All these hybrids had one and the same female form "Slava steril'naia", which was obtained by means of crossing the sterile line VIR 44 ms with the normally fertile line VIR 38.

The diagram of obtaining the seeds of hybrid VIR 42 ms (figure 7) differs little from the usually accepted plan of production of hybrid seeds. The selection station, the same as usual, reproduces seeds of four parental [Begin p.53] self-pollinated lines. Seed growing sovkhoses of the I group produce seeds of simple parental hybrids, while the seed growing sovkhoses of the II group, as well as, regional semkhoses [seed growing farms]

produce seeds of the first generation of the double hybrid for commercial plantings. The suggested plan has the following characteristics. The sterile analogue of line VIR 44 ms is maintained in reproduction with the aid of the fertile analogue of this line. The planting of two analogues is conducted in the same way as the planting on the hybridization section in obtaining a simple hybrid. The sterile analogue is sown as a female form, and the fertile - as the male. The tassels are not removed from female plants. As a result of such "hybridization" it is not the hybrid that is obtained, but the same sterile form of the line VIR 44 ms.



Conventional signs:

- ♀ - Sterile female plants
- ♂ - Fertile female plants
- ♂ - Fertile male plants
- - Sterile plants (seeds)
- - Fertile plants (seeds).

Title of figure 7. Diagram of seed growing of corn hybrid VIR 42 ms, cultivated without detasseling (male sterility of the Moldavian type is utilized, reproduction of the hybrid is carried out with its fertile form. Mixing of the two hybrid forms is accomplished during harvesting).

Words in figure 7. First section: First year. Reproduction of seeds of the line at the Experimental Station. Second section: Second year. Production of seeds of simple hybrids - parental forms of hybrid VIR 42. Line 44ms; Line 38; Line 40; Line 43. Third section: Third year. Production of seeds of the double hybrid. $F_1(44ms \times 38)ms$. Fourth section: Fourth year. Commercial plantings of the double hybrid. Mixture of seeds of hybrids VIR 42ms and VIR 42.

In growing the parental form of "Slava steril'naya" the tassels were not removed from the plants of the line VIR 44ms since they are sterile and hybridization proceeds in a natural way. It is not necessary to remove the tassels also in growing the seeds of the double hybrid. The parental form "Svetoch" does not possess the restorative ability; therefore it is necessary for the restoration of the double hybrid in commercial plantings to add to the "sterile" seeds approximately the same amount of fertile seeds, grown in the usual manner. Thus, in producing seeds of hybrid VIR 42ms the use of manual labor in hybridization is eliminated only partly.

Hybrid VIR 42ms, apparently, will be used in agricultural production in the course of the next 2-3 years. The Kuban Experimental Station VIR passed on 111c of seeds of sterile line VIR 44ms to the production from the 1958 yield; this will permit during the current year to lay out hybridization sections for the production of seeds of the first generation of the parental form of "Slava steril'naya" on an area of about 1,000 ha, and the yield [Begin p.54] from this area can provide, in 1960, for laying out sections for obtaining hybrid seeds without removal of tassels on an area of about 30 thousand ha.

At the present time the Kuban Experiment Station of VIR and the Krasnodar Scientific-Research Agricultural Institute work according to a joint program on the production of such hybrids, in which the need for detasseling would be completely eliminated.

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Some of these hybrids already are undergoing station variety testing. In the years 1959-1962, they will be tested on variety test sections and, beginning with 1962, they will have a mass distribution in kolkhozes and sovkhoses.

One should mention another important advantage of the new method of hybrid seed production. Up to the present time, owing to the shortage of seeds of the first generation, the plantings of hybrid corn rarely exceeded the bounds of old regions of its cultivation; therefore in the northern regions of the country varieties and even subsequent generations of hybrids are planted, and on an area of about 10 mln ha heterosis is not taken advantage off. In changing to the sterile type of seed growing this disadvantage will be fully eliminated.

Sidorov, F. F., and Zubkova, S. V.

Kholodoustoichivost kukuruzy

[Cold resistance in maize]

Vestnik Sel'skokhoziaistvennoi Nauki,
vol. 4, no. 6, p.55-60. June 1959. 20 V633

(In Russian)

One of the basic biological characteristics of corn is the increased requirement for heat; this restricts the possibilities of its advancement to the north. Its late ripening and, consequently, late liberation of the field for planting of winter crops reduces also the value of corn as a crop occupying the fallow. In connection with this, the production of cold resistant hybrids and varieties becomes of great importance, along with a better preparation of seeds for planting, selection of larger and smoother seeds, use of fresh reproduction seeds for planting, air-heat warming, disinfection and other measures. Nevertheless, the second course is only auxiliary since in this case the hereditary nature of corn plants is not subject to alteration and one does not succeed in obtaining considerable changes in the increase of cold resistance of plants.

The advancement of corn into more northern regions compelled the USA plant breeders, yet at the beginning of the present century,

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to pay attention to the production of cold resistant forms of corn. As a result of this, the cold resistant variety Golden Glow was isolated; it underwent wide distribution in the state of Wisconsin during the twenties of the current century. During the last 20 years a series of cold resistant varieties were produced in Holland, Germany, Poland and other countries of Central Europe. Important work on production of cold resistant varieties is conducted by plant breeders in mountainous regions of Caucasus and in countries of the Balkan peninsula.

The World Collection of Corn of VIR [All-Union Institute of Plant Industry] contains a large number of varieties, hybrids and self-pollinated lines, which differ in many important properties and characteristics, including cold resistance. The aim of the present work is to show a preliminary character in cold resistance of a series of corn specimens from various countries.

Cold resistance of various corn specimens was studied during the period of seed germination and during the period from the appearance of sprouts to the onset of temperatures, which were stable and comparatively favorable for the growth of corn, in the incubator at a temperature of 3, 6 and 10°. Two hundred specimens in all were taken for the experiment; among these 168 varieties, 26 hybrids and 6 self-pollinated lines. The specimens were planted in Petri dishes into the sterilized (roasted) sand, which was moistened to 60% before planting. This moisture content was upheld during the course of the entire experiment. Not a single specimen germinated

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in the variant with a temperature of 3°; therefore, further on the analysis will be conducted only of data obtained from variants of germination at temperatures of 6 and 10° (table 1).

Specimens from Holland had the greatest cold resistance - "Srednespelaia [Medium ripening] 35 and VC-121, which germinated on the 10th day at a temperature of 6°; the first to 30%, while the second one to 36.6%.

The Srednespelaia 39 and Srednepozdniaia 42 germinated to 23%, the local from Dagestan ASSR to 16%, Milovskaia 25 from Bashkir ASSR and Skorospelaia 10 (from Holland) to 10%. All the remaining specimens of this group germinated to less than 10%.

The least cold resistant (they sprouted only on the 10th day at temperature of 10°) proved to be the local varieties from Georgian SSR, a large number [Begin p.56] [Text continued after table 1].

Table 1

Performance of various specimens of corn in cold resistance during the period of seed germination

Origin	Varieties, which germinated at:		
	6° on the 10th day	10° on the 7th day	10° on the 10th day
USSR	Hybrid Chisminskii MB and Milovskaia 25 (from Bashkir ASSR); Kabardinsk-ala belala zubovidnala (from Kabardino-Balkarian ASSR), local K-8764 (from Dagestan ASSR)	Metto, Kavkazskaia zheltala, Vosmiriadnala, Dagestanskaia K-9349, K-11993 and K-11997 (from Dagestan ASSR); Osetinskala 1, Sterling Gorskii, K-12365 (from North-Ossetian ASSR); Omskaka 1, Sibirskaka Krasnala (from Western Siberia); Kil'benes. K-1172. K-9247 (from Kirgizia); hybrids	Liming Kubanskii, Pervaia iz vsekh (from Krasnodar krai); Egip-totsoren, K-1821; K-4018, K-4920, K-5569, K-7074, K-8361, K-8484, K-10748, K-10749, K-11953, K-11954 (from the Georgian SSR); hybrid Volochiskii, Nemerschenskaka zubovidnala, K-7975, K-8031, K-9113 (from Dnepropetrovsk oblast). Gorets Rannii, Pioneer Gorskii

(table continued on next page)

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(table 1 continued)

Origin	Varieties, which germinated at:		
	6° on the 10th day	10° on the 7th day	10° on the 10th day
Holland	Early-ripening 3 " " 7 " " 10 Medium-ripening 14, " " 15, " " 16, " " 29, " " 35, " " 39, Medium-late 42 VC-121 Fettmais [Fat corn] K-12673	Bukovinski 1, 2, 3 (from Chernovtsy oblast'); hybrids Kollektivnyi, Step- niak (from Dnepro- petrovsk oblast'). Hybrids CB-32, CB-424, Early-ri- pening 8, Early- ripening 9, Medium- ripening 22, Me- dium-ripening 22, Medium-ripening 26, Medium-ripening 40, CIV-6, W15x W85.	Osetinskaya belaya kremnistaia, K-9415 (from North-Ossetian ASSR). Early-ripening 2, Early- ripening 4, Early- ripening 5, Medium- ripening 19, Medium- ripening 20, Medium- ripening 32, Medium- ripening 37, Medium- ripening 41, Medium- late-ripening 48, C-143, PY-160036, PI-180163, CIV-KB-11, CIV-KB-184 Mendorfer, K-557, K-12061, K-12724. Albanski bel zuban Badenskaya, Original early golden ear Fleishman K-5713 Hybrids U-28, 5; simple hybrids 365, 26X23, 3X26, 24X20, Wisconsin 453, Golden Eantam, Brazilian blue, Boone County, Silver King, K-278, K-302, K-5857, K-5897, K-10811 K-2077 K-3538
Germany		Brauner	
Yugoslavia		Hybrid Martenva- sheri 5; Iridzhi 12 khetes	
Hungary			
Argentina	K-5709	Mammoth, Country Gentleman, Doll	
USA			
Mexico		K-2940	
Africa			

[Begin p.57]

of specimens from USA, as well as the comparatively large number of specimens from Holland. Nevertheless, the latter must be tested for the second time since there might have occurred an influence of accidental factors - the quality of seeds and so on.

Part of specimens, occupying an intermediate situation between the two groups cited above, are of interest. These specimens sprouted at a temperature of 10° on the 7th day to a various degree. As much as such temperature is not the most favorable for the germination of corn seeds, the specimens which sprout under such conditions in a shorter period can be considered to be more cold resistant. Only a small number of specimens sprouted to 40% and more. The most cold resistant among them proved to be the specimens from mountain regions of the Dagestan ASSR and Uzbek SSR. A comparatively high cold resistance was shown also by hybrids Bukovinskii 1 and Bukovinskii 2 (table 2).

Table 2

Amount of seeds, that germinated at a temperature of 10° on the seventh day, in different specimens of corn

Varieties	Origin	% of germinated seeds
Risovala belala (rice white)	Central Asia	58.0
Local K1172	The same	52.0
Local K-9381, K-11993	Dagestan ASSR	48.0-43.3
Hybrids Bukovinskii 1 and Bukovinskii 2	Ukrainian SSR, Chernovtsy oblast'	38.0-36.0
Local K-10071	Central Asia	18.0
" K-12365	North-Ossetian ASSR	14.0
" K-11997	Dagestan ASSR	13.3
" K-5299	Central Asia	12.0
" K-10750	North Caucasus	12.0
Hybrid Martenvasher 5	Hungary	12.0

There are varieties and hybrids of both the foreign selection, as well as those produced in USSR among the most cold resistant specimens.

We studied cold resistance of different specimens of corn during the first period of growth in two ways: 1) by early plantings of corn into the ground and 2) by keeping germinated [nakliunuv-

shiesia] seeds under conditions of reduced temperatures (3-5°). The early sowing of seeds into the ground permits, at the same time, to evaluate the initial material and to select the cold resistant forms during the most crucial period of life of the corn plant - at the beginning of the formation of vegetative and generating organs. The value of this method is reduced by the fact, that the regulation of the influence of climatic conditions is restricted to only the times of planting. The early sowing of corn is practiced in certain regions of Rumania; owing to this, with the onset of warm weather after the recurring spring fall of temperature, the seeds begin to grow fast. This method can be used also in many regions of the Soviet Union in planting corn varieties, which are cold resistant during the first period of development.

On May 11, 1957, seeds of 200 specimens of corn were sown on the fields of kolkhoz "Iskra" of Vsevolozhsk raion, Leningrad oblast', on the section of the vegetable crop rotation (predecessor--potatoes). At the moment of planting the temperature of the air was 15.2°, and the temperature of the soil 10°. On the 10th day simultaneous sprouts appeared on all planted specimens, and at the end of May all specimens attained the phase of 2-3 leaves.

[Begin p.58] Beginning with May 23 the temperature dropped and during the night of May 28 to 29th a frost was recorded. Part of the specimens - ^[Early-ripening] Skorospelala 1, ^[Medium-ripening] Srednespelala 29, Srednespelala 33 (from Holland), Maleksberger (from Germany), Vassfele 116 os

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(from Hungary), hybrid MDX63-54 and self-pollinated line 153R (from USA) - were damaged only slightly. But part of the specimens were lost entirely. Ruse yellow, Ruse white, Ruchi white, Gostila Sul'eva white (from Albania), hybrids 7735, 7745, 7746 (from Canada), hybrid K2, Corn 191; self-pollinated lines 42, 179, MBR, VVO (from USA).

The frost served as a provocative background for discovering the most cold resistant forms, as the damaged plants found themselves under conditions of low temperatures, which continued during the course of the first ten days and of the most part of the second ten days of the month of June*.

Observations of the dynamics of growth of plants showed very considerable differences among the studied specimens (table 3).

The evaluation of damage after the frost on May 29, accepted by us, was drawn up according to the following principle: mark 5 - leaves were very slightly touched by the frost; 4 - yellowing of leaves; 3 - leaves were damaged by frost by $\frac{1}{2}$; 2 - leaves were damaged by $\frac{1}{4}$; 1 - leaves were damaged by $\frac{3}{4}$.

Evaluation of plants on June 17 was conducted by taking into consideration the characteristics of the growth of plants during

*According to data of the nearest meteorological station, the average daily temperature of air during this period was: in May - 30th - 8.6°, 31st - 10.1°, in June, 1st - 8.9°, 2nd - 8.0°, 3rd - 11.0°, 4th - 10.8°, 5th - 11.0°, 6th - 9.3°, 7th - 10.4°, 8th - 11.4°, 9th - 13.8°, 10th - 19.4°, 11th - 22.2°, 12th - 21.4°, 13th - 14.2°, 14th - 11.5°, 15th - 11.0°, 16th - 12.6°, 17th - 13.8°.

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this period: mark 1 - the plants are strongly inhibited, the frost damage is expressed fairly strongly; 2 - the plants are less inhibited, but the frost damage, nevertheless, is expressed quite strongly; 3 - plants started growing, but frost damage is yet quite strongly expressed; 4 - the plants began to grow, frost damage is expressed already slightly; 5 - plants have formed new leaves, damage of leaves by frost is hardly noticeable.

As it is seen from table 3, specimens C-2, Saratovskii hybrid, Belolano psheno, Grushevskaiia (USSR), SV-412, ^[Medium-ripening] Srednespeliy¹ 36 and 37 (Holland), Bukovarskii zuban and Rumski zlatni zuban (Yugoslavia), self-pollinated line B-8, hybrids 853-7655, 852-651 (USA) have good indices on cold resistance. Such specimens as the self-pollinated line 191 and K-12791, 12797, 12805 and some others (USA), white dent (Korea) proved to be unable to withstand the reduced temperatures during the course of a prolonged time and suffered strongly during this period. It was recorded that not even one of the specimens, which suffered strongly from frost, attained the maximum mark of evaluation, which the specimens had that underwent a slighter damage.

The negative effect of reduced temperatures during the period from May 29 to June 17 was the strongest for late-ripening southern varieties with a long vegetative period.

Studies of cold resistance of corn by means of keeping the ^[nakliunovshiesia] burst seeds during the course of two weeks at a temperature of

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3-5° were conducted with a collection of 50 specimens. On June 6 the seeds were planted into the open ground; dry seeds, which were soaked in water for 24 hours, served as a control. Keeping the germinated [nakluinuvshiesia] seeds at a reduced temperature should have caused a sharp reduction of the field sprouting in heat-loving specimens.

On the basis of different field germinations of seeds, which were soaked for 24 hours at room temperature before planting, and of seeds, which were kept at (text is continued after table 3)

[Begin p.59]

Table 3

Evaluation of corn specimens for cold resistance during the first period of their growth

Variety	Subspecies	Origin	Evaluation in marks	
			on May 29	on June 17
MDX63-54	flint	USA	4	5
CB-412	dent	Holland	4	5
Meleksberger	flint	Germany	4	5
5-2 and Saratov hybrid Belolarioe psheno, Omsk 1 and Pervenets	"	Saratov oblast'	4	5
Medium-ripening 36 and 37	"	Western Siberia	4	4
Bukovarski zuban and Rumski zlatki zuban	dent	Holland	4	4
"Algonguin" [Algonguin] and self-pollinated line B-8	"	Yugoslavia	4	4
Hybrid Early Blend	"	USA	4	4
Shindelmaizer and Vorargelber	sweet	Canada	4	4
Pervomaiskaia	flint	Germany	4	4
	"	Orenburg oblast'	4	4

(table continued on next page)

(table 3 continued)

Gloria Ianatskogo	flint	Germany	4	4
Sterling	dent	North Caucasus	4	4
Grushevskaya	flint	Dnepropetrovsk oblast'	3	4
Indian corn	starchy	USA	3	4
Medium-ripening 31, 33 and 34	dent	Holland	3	4
Leningradka	flint	Leningrad oblast'	3	3
Self-pollinated lines 62 and 153R	dent	USA	3	3
White dent	"	Korea	4	3
Kympla Turzyi and Moara Domniaska	flint	Rumania	4	3
Chimgauer	"	Germany	2	4
Vass fele 15 os	"	Hungary	2	2
Self-pollinated line 191	"	USA	3	1
Shidski zuban, No- vosadski zlatni zu- ban and Bel'ski zuban	dent	Yugoslavia	4	4
CB-45, C-6, Kal'- dera 221	dent and flint	Holland	4	4
ukuruza uluch- shenaya 261 [im- proved corn]	dent	Zakarpatsk oblast	4	4
Hybrids Pioneer 377 and 382	"	USA	4	4
Mostard Erli Peri	"	Germany	4	4
Ottawa CO-13	sweet	Canada	3	4
Allan	dent	North-Ossetian ASSR	3	4
Imeretinskii hybrid, Kartuli krugi and Adzhamestskaya be- laya	flint			
Hybrid early Moara Domniaska X Oran- zhevyi-Tyrgu Frumos	dent	Georgian SSR	4	3
Odesskaya 10	flint	Rumania	4	3
Osetinskaya 1 and G-676	dent	Odessa oblast'	4	3
Medium-ripening 15	flint	North-Ossetian ASSR	4	3
Moscow rannaya	"	Holland	3	3
Samaya rannaya and Rannaya zhemchu- zhina	dent	Moscow oblast'	3	3
Mestnaya and Polud- menno semennaya belaya	sweet	North Caucasus	3	3
	dent	Albania	3	3

(table continued on next page)

(table 3 continued)

Hybrids ANR-4.14, Wisconsin 355, self- pollinated line M14, 8/11	dent	USA	3	3
Self-pollinated line 1	"	USA	3	2
Silosnala kukuruza [Silage corn]	"	Germany	2	2

[Begin p.60]

reduced temperatures, it is possible to give an idea about the cold resistance of the specimens. Hybrids Kollektivnyi, VIR 25, Progress, Uspekh, Krasnodarskii 4, ChB, VIR 10, VIR 37, VIR 16, Bukovinskii 1 and certain others proved to be the most resistant, as well as several varieties of the selection of northern regions of corn cultivation for seeds and varieties of selection of foot hill regions of Caucasus: Chishminskaiia 1, Voronezhskaiia 80, Khar'kovskaiia 23, Rozenbergskaiia, Dnepropetrovskaiia, Sterling, Kabardinskaiia white dent. Seeds of certain varieties and hybrids did not germinate at all after keeping them at a reduced temperature: hybrid VIR 42, variety Kartuli Krugi; seeds of hybrid VIR 50 germinated only to 15%.

The cited method of evaluation merits attention for use in practical selection work since it is practicable to any selection institution which has the most primitive refrigerator. The simplicity in conducting this work permits to make an evaluation on cold resistance to a large number of selection material without especially large investment and expenditure.

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Ivashko, A. A.

Novelshie pribory dlia issledovaniia v sel'skom
khoziaistve (K itogam Mezhdunarodnoi peredvizhnoi
vystavki priborov v Moskve*)

[The newest devices for research in agriculture (On
the results of the International Travelling Exhibi-
tion of Devices in Moscow)]

Vestnik Sel'skokhoziaistvennoi Nauki, vol. 4, no. 6,
p.88-97. June, 1959 20 V633

(In Russian)

The International Travelling Exhibition of Devices, intended for agricultural research, which was organized on the initiative of VASKHNIL [All-Union Academy of Agricultural Sciences imeni V. I. Lenin], is an event, which will speed up the development of science and the rise of agricultural production both in USSR, as well as in the countries of the socialistic camp. This first exhibition, which represented an international result of progress in the field of measuring devices for agricultural purposes, was visited by about 90 thousand persons during the period of its stay in Moscow, beginning January 25 and up to March 25.

The liveliest interest, that was aroused by the exhibition, confirms its actuality and opportuneness. Acquaintance with more than a thousand exhibits in all the fields of agricultural sciences gave the possibility to the specialists to become oriented in the

Candidate of Technical Sciences

* See journal "Vestnik Sel'skokhoziaistvennoi nauki", no. 2, 1959.
p.143-145.

selection of methods and experimental devices for the solution of scientific problems. The exhibition has pointed out new possibilities, which are opening owing to the creation of new means and methods of observations and measurements.

Specialists of designing and apparatus-building establishments saw at the exhibition examples for development of new devices both for scientific research, as well as for the control and regulation of agricultural processes, for determination of the quantity and quality of production.

Undoubtedly the exhibition will spur the organization of wide production of devices for agricultural purposes in our domestic enterprises.

In 1958, the Academy of Agricultural Sciences imeni V. I. Lenin began development of the construction of agricultural devices; the Central Experimental-Designing Bureau on Building of Devices has been organized and an experimental apparatus-building factory began to work.

The exhibition will produce a great effect also on the coordination of device building among the participating countries. The exhibition has shown that the modern nomenclature of devices, needed for scientific research in the field of agriculture, is so wide that its mastering is difficult even in the country with a highly developed apparatus-building industry. And as much as many of them are required in very small numbers, it is obvious that their production in every country will be economically inexpedient,

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[Begin p.89] and for many countries even impossible. The survey of exhibits, which were presented by countries participating in the exhibition, showed that there are groups of devices which are better presented by one of the countries and, naturally, it would be more expedient to produce them in the given country instead of duplicating them in different countries.

Economic expediency of such a coordination of apparatus-building is so much needed for all the countries of the socialistic camp, that the exhibition will justify itself highly by solving this one question.

Data of the exhibition's survey permit to express certain preliminary conclusions. For instance, a group of devices for polarographic research of the chemical composition of substances received its highest development in the Czechoslovak Republic. Here began and developed the method of polarographic research under the leadership of its creator, Academician V. Geirovski. In the Hungarian People's Republic devices for research of fibrous materials (cotton, wool, fabrics) have a wide distribution. The Polish People's Republic is almost the only country, which presented a system of devices for research in the field of forestry (horticulture) and singular apparatuses for studying the biology of plants. The German Democratic Republic has presented high quality optical apparatuses and laboratory equipment for various purposes.

In USSR devices for research in the field of animal husbandry and veterinary science, for examination of tractors and agricultural machinery, apparatuses for research with the use of radioactive isotopes, radiations and semiconductors were the best presented.

The level of development of the measuring technique for the basic branches of agricultural science, as well as by countries, can be presented in the following table.

Class	Number of devices according to countries				
	Hungarian People's Republic	German Democratic Republic	Polish People's Republic	Czechoslovak Republic	USSR
1. Devices for research on plants, soils and the surface layer of air	25	39	26	40	194
2. Devices for research on animal husbandry and veterinary science	36	12	3	34	106
3. Devices for evaluation of quality and quantity of agricultural production	26	8	7	12	57
4. Devices for examination of the work of tractors and of agricultural machinery	6	14	1	1	47
5. Devices for the examination of work of power installations	28	-	-	16	67
6. Devices and equipment for the general purpose	83	31	4	53	115
7. Devices, based on use of radioactive isotopes and radiations	8	1	4	3	42
In all	212	105	45	159	628

[Begin p.90]

The table shows that the development of device-building is uneven for both the various sections of agricultural sciences, as well as the countries. For instance, the western countries presented very few devices for examination of work of tractors and agricultural machines since the mechanization of agricultural processes began there only recently. In these countries there are also few devices, based on the use of radioactive isotopes, radiations and semiconductors.

The highest development, in all the participating countries, was in devices for research of the chemical composition of plant materials, soils, fertilizers, as well as physics of the soil and of the surface layer of air. More than 300 devices were designed for these purposes among the number of those shown at the exhibition.

This is explained by high development of chemistry in all the branches of national economy.

One should point out, that there were exhibited very few devices for the research into physical-mechanical characteristics of plants; this appears to be the result of very slight development of elaboration in this field. Very few devices were produced also for research of gaseous exchange and photosynthesis of plants. Only three apparatuses were shown for this important problem, among which two were the first experimental specimens.

The Committee, appointed by the Presidium of the Academy, selected 411 devices among all the sections of the exhibition (173 native and 238 foreign), which were the most promising for use in scientific research and in agricultural production of USSR.

In their selection the Committee invited specialists from scientific-research institutes of VASKHNIL, TSKHA [Timiriachev Agricultural Academy], of the Academy of Science of USSR, from the All-Union Society of Apparatus-Building, from the exhibition, as well as specialists from among the visitors.

Two circumstances were taken into consideration during the selection, actuality of research, for which the devices were destined, and the existence of other means of measuring for the given purposes.

If for one purpose there were presented several designs or types of devices, then by means of comparison those devices were chosen, which possessed the greatest number of positive qualities: high productiveness, accuracy, facility in exploitation, and so on.

Along with the selection, the Committee determined also the means of supplying them to the scientific institutions.

The Committee recommended buying about 7,000 specimens of devices for operation in scientific-research and educational institutions from among the 77 kinds of selected foreign apparatuses. Besides this, it was recommended to buy one specimen each of the 99 kinds of devices, which presented interest in their separate parts, for their study and use in development of new apparatuses.

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Part of devices, which were required in considerable numbers of specimens, were recommended for mastering by the national production.

Let us now point out some of the devices, among the number of the selected by the Committee, which merit special attention.

Czechoslovak Republic presented five devices for polarographic research in the section of apparatuses for plant research. Each of them is for a special purpose, and all of them represent a scheme of apparatuses for scientific-research of paramount importance. Micropolarigraph M-103 (figure 1) was designed for determining the contents of various substances in solutions. It is used in biochemical and chemical research in mass analyses. The device is composed of a galvanometer, of a photographic adapter, abscissa lamp, potentiometric cylinder with a drive and a polarographic [Begin p.91] machine with electrodes. The remarkable thing in these devices is that with their aid it is possible to conduct mass determinations of contents of a large amount of different substances, including also the contents of vitamins in fruits, vegetables and other products.

Polarigraph AP-55 was designed for polarographic analyses, requiring increased exactness. Polariscope (figure 2) gives a new possibility for scientific research to observe the course of the polarographic analysis on a screen.

Title of figure 1. Micropolarigraph
(Czechoslovakia).

Title of figure 2. Polariscope (Czechoslovakia)

Title of figure 3. Automatic polarigraph (Hungary).

Hungarian automatic polarigraph deserves special attention (figure 3). The device can conduct an analysis of solutions of a very small concentration to 10^{-6} mole/liter in the presence of very small amounts of the solution (0.1-0.2 milliliter). The result can be observed during the process of the analysis directly on the polarogram, owing to the presence of an electronic amplifier and a mechanism for direct registration. Moreover, no darkening of the room is required, no photographic work for developing polarograms, nor any special vibroprotecting mechanisms. The potential arising on the electrodes can be read during the process of analysis at any moment not alone on the polarogram, but also on the control voltmeter. This is attained by the fact, that the moving of the paper ribbon and the change of the voltage through the potentiometer are carried out by one motor; thus, a synchronism is attained between the speed of the ribbon and the voltage. The time of polarogram recording can be adjusted to 3, 6 and 9 minutes. The device is disconnected automatically after the end of the analysis and the recording of the polarogram. The order of polarization of chemical substances in the solution [Begin p.92] and the recording of polarograms, can be adjusted, as desired, at a voltage increasing from zero or decreasing from the maximum.

The mechanism, feeding the paper ribbon, can work also independently of the voltage. Owing to this, registration of the change of the diffusion current is possible at constant voltage; this also permits producing amperometric titration. Current measure-

ment can be carried out also with the precision from $1 \cdot 10^{-9}$ to $8 \cdot 10^{-6}$ a, in 28 stages.

A resistance is provided for in the construction, with the aid of which it is possible to check the efficiency of the device. It is possible to register the differential by a special mechanism made of RC elements. In cases when the voltage in the supply system fluctuates more than by 10%, the feeding can be conveyed to the electrodes from an outside storage battery.

Nevertheless, with all the positive characteristics of this device, according to the information of specialists, substantial kinks exist in some specimens, which hamper their use.

Automatic titrimeters (Hungary) present a great interest. Titrimeter of the type 7-77-1/C (figure 4) works according to the principle of a potentiometer. After the end of the process of titration, when the potential reaches a definite intensity, the device is cut off automatically. The peculiarity of this device consists of the fact that the titrating solution is measured out by the unit of the electronic control. The dose of solution, which is fed in titration, decreases from 1.5 to 2.0 ml at the beginning to 0.025-0.050 ml at the end of titration. Whereupon the decrease of doses, as well as the change of time intervals between the feedings is in proportion to the logarithm of the concentration of the titrate.

Accuracy of registration of the neutralization potential is ± 5 m volt.

Title of figure 4. Automatic titrimeter
(Hungary).

Three devices were shown at the exhibition for research on gaseous exchange and photosynthesis of plants and microorganisms. The Warburg apparatus (German Democratic Republic) is a set of 12 Erlenmeyer flasks into which the examined objects are placed: particles of plants, bacteria, and so on (figure 5). During the process of their respiration and photosynthesis the composition of gaseous fluid changes in the flasks, and, consequently, also does its pressure; this is registered by manometers, that are connected with the flasks. In order to keep up the needed temperature in the flasks the device is provided with a water bath with an electric heating apparatus, a thermoregulator and an agitator.

Microrespirometer (figure 6), which was exhibited by the Polish Academy of Science, is a new, interesting development in the field of research on photosynthesis of microscopic objects.

The nature of operation of the apparatus consists in its revealing the possibility for investigation of the gaseous exchange and photosynthesis of bacteria, of plant particles, of several cells, and so on. This is attained by a miniature construction of a respiration chamber of a volume of 0.7 cub. cm into which the microscopic object is introduced in a drop of water, which is placed on the covering glass [Begin p.93] that hermetically closes the chamber. The respirational chamber is connected with a sensitive manometer, which is filled with a liquid that does not adhere to the glass. A special microscope is mounted over the

manometer's dial for a precise reckoning of its readings. Use of an illuminating mechanism with light filters for various degrees of illumination of the investigated object with different colors of the light spectrum proves to be the novelty of this device.

The Institute of Physiology of Plants of the Academy of Science of USSR presented at the exhibition a device for research of the gaseous exchange and photosynthesis of plants with the use of the carbon isotope C^{14} . The air with $C^{14}O_2$ circulates in a closed system of the device and bathes the investigated leaf, which may be separated or inseparated from the plant. If the carbon is absorbed by the leaf then the radioactive radiation, which is recorded by the counting tube during a certain period of time, is reduced. This device can be utilized for examination of the gaseous exchange of plants under field conditions, if the electric motor mounted on it is replaced by a clock-work spring mechanism.

Title of figure 5. Warburg apparatus (German Democratic Republic).

Title of figure 6. Microrespirometer (Poland).

Title of figure 7. Device for determining the speed of movement of microparticles (Poland).

A device for measuring the speed of movement of microscopic particles in plasmas (Polish People's Republic) is shown in figure 7. The main point of the device consists in the fact that a revolving scale is mounted in the eyepiece of the microscope and it is connected, kinematically, with the Kymograph. For measuring

the speed of movement of microparticles, observed under the microscope, a similar to it speed of the scale is set up with the aid of a buncher; and it is then automatically recorded on the kymograph. It is the only device produced for the first time for such purposes.

Among the devices designed for research in the field of animal husbandry, [Begin p.94] the devices for research of physiological functions of animals: respiration, pulse, movements in digestive organs, and so on, are of considerable scientific interest; also devices for research in the composition of blood, composition of feeds, and others.

Title of figure 8. Radioteleactograph by
B. V. Panin (USSR).

Title of figure 9. Automatic classifier
of cotton fibres in length (Hungary)

Title of figure 10. Measuring device of
radiations (Hungary).

Radioteleactograph of B. V. Panin (figure 8) permits to conduct investigations of the physiological condition of animals on pastures, situated at a distance up to 15 km from the researcher. A sending apparatus with a transmitting instrument, from which radioimpulses can be transmitted to the receiving station and register on a paper ribbon, is attached to the animal.

The portable sets for artificial insemination of animals, shown at the International Travelling Exhibition, are of great practical interest.

The Hungarian People's Republic presented a group of devices for examination of fibrous materials: cotton, wool and others. The automatic classifier of cotton fibres in length (figure 9) is of special interest among them. The apparatus measures the length of fibres, classifies them in groups by length and records the diagram of the quantitative distribution of fibres according to these groups. The device takes place of the painstaking and labor consuming work of laboratory workers, and in 3-5 minutes gives the full characteristic of the cotton specimen in the form of a diagram.

Over ten devices were exhibited, which measure the moisture within grains, the soil and in other agricultural objects. The Hungarian electronic hygrometer "gigromatik" attracted the attention of specialists among them. It was designed for a quick determination of moisture in grains of various crops. The principle of its functioning is based on the dependence between the moisture and the dielectric properties of the grain, which is placed into a special hopper of a certain volume. This device can [Begin p.95] measure the humidity with an accuracy up to 0.5%, if its contents in the grain do not exceed 30%. The device is convenient for transportation (its weight is 8 kg) and for measuring moisture both for scientific and production purposes.

In the section "Radioactive isotopes and radiations in agriculture" about 60 devices were exhibited for the examination of the effect of radiations on agricultural objects, for control and

automation of technological processes and for other purposes. The Hungarian composite calculator Orion 1873 (figure 10) is especially useful for scientific research. It consists of an electronic counter tube, an integral amplitude discriminator, high-voltage stabilized rectifier for feeding gas-discharge and scintillation counters and a tripping system. This universal device takes place of four laboratory apparatuses.

The Hungarian piezoelectric double-beam pressure indicator (figure 11) was marked as the most important among the number of devices, designed for research on power plants. It represents a complex of devices and appliances for investigation of pressures of gases in cylinders of various engines.

Title of figure 11. Piezoelectric double-beam indicator of pressure (Hungary).

Title of figure 12. Diaprojection apparatus (Hungary)

At the International Travelling Exhibition of Devices, along with the measuring devices new, original equipment for scientific-research and educational laboratories were also presented. For instance, in figure 12 is shown a portable diaprojection [Begin p.96] apparatus (Hungary), with the aid of which it is possible to project on the screen microphotographs of biological and other objects with a 1,000-fold magnification. The German Democratic Republic presented sectional laboratory tables (figure 13), which attracted great attention of specialists by the efficiency of the construction, as well as by the heat and acid-proof coatings.

**Title of figure 13. Laboratory table
(German Democratic Republic).**

At the International Travelling Exhibition, along with devices of complicated layouts, were also shown simple, but very effective apparatuses. For instance, an ultraviolet illuminator differed from an ordinary table lamp only by the use of a mercury-quartz lamp SVD-120A; nevertheless the interest of visitors of different specialties in this apparatus was exceptional. Actually the device can be useful both for scientific-research, as well as for solving many production problems, that are connected with the determination of quality of the most different organic materials. It is sufficient, for instance, to illuminate the seeds with it in order to discover on them any changes, which cannot be discovered by any other methods. The device is based on the long known property of all substances to give off, when placed in ultraviolet rays, a luminiscent radiance of a special color inherent only to the given substance. It is possible by this simple reliable and convenient method to discover any changes on the surface of seeds, plant leaves, fruits, tubers and other agricultural products, any mechanical or chemical changes at the very beginning of their development, when they are as yet imperceptible to the naked eye.

It is possible by the simple device of Prikladov to determine the contents of moisture in seeds. The Committee recommended to make a set out of similar devices for field laboratories, agriculturists and zootechnicians of kolkhozes and sovkhoses. It is

recommended to include into the outfit the portable laboratory of Peive for determination of the most important chemical elements of the soil and of fertilizers; a refractometer for the determination of contents of sugar in beets, fruits, vegetables and other agricultural products; a toluene thermometer in a durable steel holder, which would be convenient for the determination of the temperature of soil, seeds, that are stored in great masses; soil and silo borers for taking specimens; a portable device for determination of the quality of fodders, and others. [Begin p.97] Outfits of these devices will help agriculturists and zootechnicians of kolkhozes and sovkhozes to solve production problems not by groping and guessing, but on the basis of objective measurements.

A survey of exhibits at the International Travelling Exhibition showed that for the most part, in the field of construction of devices for agricultural purposes, the tendency of scientists and designers is for automation of the operations of analyses and measurings; for shortening their length to the maximum; for increasing accuracy and objectivity.

An ever greater development is accorded to those measuring devices, which act without destroying the objects of research; for instance, the moisture content of plant material without their desiccation, or of soils without the destruction of their natural structure.

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It is particularly important that the exhibition is a traveling one. In moving from country to country it will be constantly enriched with new exhibits and, therefore, will not alone sum up, but also present the dynamics of development of international apparatus construction for agricultural purposes.

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**General Meeting of the Department of Biological
Sciences of the Academy of Sciences of USSR**

Akademii Nauk SSSR, Izvestia, Seria Biologi-
cheskaja no. 4, p. 638-640. July/Aug. 1959. 511 Sa2B

(In Russian)

The General Meeting of the Department of Biological Sciences took place on March 24-25 in the Conference Hall of the Main Botanical Garden. The report on the activity of the Department of Biological Sciences, for 1958, was discussed during the sessions, as well as problems of biological science in the light of decisions of the 21st Congress of KPSS. [Communist Party of the Soviet Union]. The activity of the members of the Department during the past year was also analyzed. Election of a new Academician-Secretary took place at the General Meeting in connection with the expiration of the time of the commission of the Academician V. A. Engel'gardt. Two scientific reports were heard during the last, evening session, on March 25: of I. V. Tiurin - "Soil-geographical and experimental works of the Soil Institute imeni V. V. Dokuchaeva of the AN SSSR [Academy of Science of USSR], their scientific and practical value" and of E. A. Asratian - "Effect of denervation of the cerebrum on the regulation of the function of the organism".

Academician-Secretary, V. A. Engel'gardt came forward with the report about the activity of the OBN [Department of Biological Science]. In connection with the fact that the text of the

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report was manifolded earlier and sent out to the members of the General Meeting, the speaker mentioned only briefly the most important scientific and scientific-organizational problems, which characterized the activity of OBN during the year 1958. Basic attention was given over to problems of the biological science in the light of decisions of the 21st Congress of KPSS. Dwelling on the importance of historical decisions of the 21st Congress and on the serious critical remarks about some deficiencies in the work of the scientific institutions of OBN, the speaker pointed out that to the lot of the Department of Biological Sciences of AN SSSR fell many exceptionally important problems, since biology developed theoretical premises for both the medical as well as for the agricultural sciences. Basically, the report was given over to the consideration of prospects of development of individual trends in biology for the next seven years.

The speaker pointed out that in the resolution of the 21st Congress of KPSS those basic branches of biology were named, which must be developed by biologists during the next seven years in the first place; namely, biophysics, biochemistry, microbiology, virology, agrochemistry, selection and genetics.

In the development of these sciences, such problems as perception of physico-chemical and structural principles of elementary living processes, research on the morphology and physiology of cells and mastering the processes of metabolism acquire a special importance. Work on the studies of protein structure and of nucleo-

proteids is of fundamental importance.

It is necessary to deepen the research on the clarification of the interaction of the form and function at the microscopic level and, especially, submicroscopic studies of structures in the field of cytology and genetics. Much attention must be given to the investigation of chemical and physical elements of heredity as well as development of the emergence and inheritance of characteristics of the organism and the role, in this process, of interaction of the organism with the environment.

Of utmost importance are also the problems on the study of mechanisms and rules of action of nuclear radiations on the metabolism, as well as development of measures for the protection from the effect of radiation.

Research on biochemistry and physiology of microorganisms and viruses must be developed, while working together with biochemists, cytologists, biophysicists. One should expect the mastering of bacterial synthesis of many specific substances-products of vital activity of microorganisms; this should find wide use in the economics of the country and in medicine.

Progress in the physiology of man and animals must be the basis for solving many important and actual problems of theoretical and practical medicine, as well as of the animal industry. The work on studies of conditions of existence and efficiency of men under extreme conditions, development of measures for efficient protection of the organism from the effect of radiation and measures

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to counteract the effects of these reactions, acquire a special importance.

Much attention must be given to the development of physiological principles for high yields. In this direction, in the first place, one can expect great discoveries in the field of photosynthesis. All this will bring us nearer to mastering the given process in plants and will help, finally, in realizing photosynthesis under artificial (industrial) conditions. Much attention must also be paid to the regulation of physiological processes in plants. [Begin p.639]

An ever fuller and versatile mastering and utilization of soil resources, as well as of the plant and animal world of the Soviet Union are required. It is necessary to increase, during the next seven years, the work on the control of agricultural and forest pests (Eurygaster, silkworm moth, weeds, and so on), on pathogens and carriers of diseases of men, animals and agricultural crops.

For a much quicker and a more purposeful perception of the country's resources, it is necessary to work out new methods and new practical forms of their studies. At the same time a wide, complex method of research, combining field investigations with experimental work, must be of special value.

On the basis of such complex, many-sided studies of natural resources, a regionalizing of the USSR territory for national economy purposes should be made; directions be prepared for wide circles

of practical workers, as well as methodical manuals for a more efficient industrial utilization and conservation of these riches; also for the control of all sorts of phenomena, which reduce their value.

The scientific activity of academicians and of corresponding members of the Department was described in the report of the Assistant Academician-Secretary, Academician V. N. Sukachev. The speaker again mentioned the small number of academicians and corresponding member[biologists in the Department which is one of the greatest according to the number of its scientific establishments. The extreme overloading of academicians and corresponding members with work was mentioned again, as in the preceding years. OBN's Bureau, as yet, did not carry out the work on investigating the overloading of members of the Department.

Reports and the acquaintance with the record of the OBN aroused lively discussions. B. N. Stepanenko, Kh. S. Koshtolants, V. L. Ryzhkov, F. N. Pavlovskii, A. A. Imshenetskii, M. S. Giliarov, G. V. Nikol'skii, A. N. Bakulev, A. V. Palladin, V. N. Chernigovskii, N. A. Avrorin, V. P. Peimers, E. N. Mishustin, and others took part in the debate.

The meeting pointed out that the scientific and scientific-organizational activity of OBN's institutions was carried out according to a plan approved by the Presidium of the AN SSSR for scientific-research works and the plan of inculcation. The staffs of permanent scientific councils on problems were manned and new

scientific societies were formed for the improvement of the organization of research. The scientific councils on problems and the societies are the most successful forms of organizations for guidance of science and for coordination of the scientific activity of institutions of different services. Data were developed on three new problems and appropriate reports, concerning them, prepared ("Hydrobiological processes and means for controlling them", "Biochemical principles for improvement of technology of the food industry", "Main questions of physiology and morphology of animals and man"). Remaking of such reports as "Basic regularities of the biological effect of nuclear radiation" and "Physical and chemical elements of heredity" was carried out.

The Presidium approved two new societies at the Academy of Science: the All-Union Society of Biochemists and the All-Union Microbiological Society. More precise definitions were introduced into the structure of scientific institutions that enter the makeup of OBN and the branch offices of the AN SSSR. In several scientific institutions the laboratories, that were too large, were subdivided and new structural units were formed. At the Institute of the Morphology of Animals, for instance, such independent groups were formed as the group of biochemistry of cellular structures, ecological physiology, cytology of the Protozoa and the ecological morphology of water mammals. At the Institute of Biophysics, in order to subdivide overlarge laboratories of radiobiology and biophysics of living structures, independent

groups were formed, having the right of an office - an office of physics of biopolymers, an office of special methods of microscopy, an office of theoretical principles for the protection from radiation, and others.

It was pointed out, that during the past year the international scientific contact has grown considerably and became stronger, especially with countries of people's democracies. Collaboration with China was on a large scale; 50 biologists went there to take part in the development of 19 problems in biology. In all, about 280 Soviet biologists visited the foreign countries; among them 180 took part in 42 international congresses and meetings, and about 100 went for a protracted work in scientific institutions and for rendering consultative help.

At the same time it was mentioned at the meeting, that substantial deficiencies have their place in the activity of the Department of Biological Sciences. To the number of these, in the first place, belongs the weak bond with scientific-research and production organizations in agriculture, individual branches of light and food industry, as well as sanitation.

A great defect appears to be in the case that no proper connections were organized with institutions of the Department of Physical-Mathematical Sciences of the Department of Chemical Sciences, Department of Geological-Geographical Sciences of the Academy of Science of USSR, and so on.

A serious omission in the work of the OBN's Bureau was the absence of discussions and debates on general biological problems during the current year.

Considering the problems of Biological Sciences in the light of decisions of the 21st Congress of KPSS and taking into consideration serious critical comments, which were made at the December Plenum of TsK KPSS [Central Committee of the Communist Party of the Soviet Union] the General Meeting stressed the great responsibility of the Department of Biological Sciences in the formation of theoretical principles for practical measures in the field of agriculture, of sanitation and other branches of national economy of USSR. [Begin p.640]

The results of scientific works, as they accumulate, must be widely tested and actively introduced into practice of the national economy and sanitation through the institutions of VASKHNIL [All-Union Academy of Agricultural Sciences imeni V. I. Lenin], of the Academy of Medical Sciences of USSR, Ministries and Councils of National Economy.

The General Meeting adapted a resolution, the text of which is cited below:

1. To approve the basic trends in the development of biological sciences, which were stated in the report of the Academician V. A. Engel'gardt, taking into consideration comments and wishes expressed during the discussion of this report.

To entrust the OBN's Bureau with the introduction to the Presidium of the AN SSSR [Academy of Science of USSR] of particular suggestions on the specification of the prospective plan for the development of biological sciences for the next seven years, on the basis of decisions of the 21st Congress of the Party and the December Plenum of the TsK KPSS.

2. In connection with unfortunate or inaccurate formulations in the presented report, which were mentioned at the General Meeting of the Department, to entrust the OBN's Bureau in a week's time to adjust and finally to edit the text of the report after consultations with the Directors of the Institutes.

3. At the present level of development of science, the use of achievements of physics, chemistry and other allied sciences is of extreme importance for the solving of biological problems.

In order to unite the efforts of biologists, physicists, chemists and other specialists, the General Meeting considers it highly desirable to coordinate the activity of the OBN with the Department of Physical-Mathematical Sciences, Department of Chemical Sciences and Department of Geological-Geographical Sciences for the solving of a whole series of big interdepartmental problems, and in connection with it asks the Presidium of the AN SSSR about the formation of interdepartmental problem councils for solving the most essential complex problems.

4. In every way to strengthen the contact between the Department of Biological Sciences of the Academy of Sciences of USSR with

the Academy of Medical Sciences of USSR and the VASKNNIL, by widening and brisking up the activity of the Councils on Problems, attracting for the solution of the main problems a wide circle of scientific and practical workers.

5. To draw the attention of the OBN's Bureau to the need of greater corrdination, actual help and strengthening of scientific bonds with the Academies of Sciences of the allied republics, with the Siberian Branch of AN SSSR and the subsidiary of AN SSSR.

6. To entrust the Bureau of the Department of Biological Sciences with persistent trying to get from the Presidium of AN SSSR the means for widening the working areas of scientific establishments of the Department by way of construction of new buildings, as well as by assigning some money for material-technical equipment for institutes and laboratories of the Department, in order to create for them conditions for wide utilization of the newest methods of research in biology.

7. To attract the attention of the Presidium of AN SSSR to the need of formation in the system of AN SSSR of a factory for the manufacture of apparatuses, as well as of special laboratories for the output of synthetic organic substances, labeled for a definite state.

8. The General Meeting entrusts the Department of Biological Sciences to put into practice the conducting of debates and discussions on the basic and the most important general biological problems, which affect the interests of biologists of different

specialties, attracting a wide number of active members, both among scientists and practical workers.

To recognize, as a certain success for the Department, the founding of two new journals - "Cytology" and "Paleontology".

To entrust the Bureau of the OBN to continue in persistently carrying out of the realization of the full program of the planned periodic publications; it is also very desirable that the individual reports of the academicians be published in a combined book.

10. To draw the attention of the OBN's Bureau to the expediency of debating at the meetings of the Bureau of only the fundamental and big organizational problems of the biological science, but solving the small current matters during the course of work.

11. The General Meeting states the matter about the wholly insufficient personal staff of the Department of Biological Sciences, and in connection with the vast problems, facing the biological science, addresses the Presidium of the AN SSSR with a request for the expansion of the body of active members and of corresponding-members of the Department.

After adapting the resolution, the General Meeting expressed the confidence that biological scientists, inspired by the decisions of the 21st Congress of the Communist Party will devote all their strength, knowledge and energy to the job of construction of the Communist society.

After the approval of the report, V. A. Engel'gardt made an announcement that he resigned as the Academician-Secretary of the Department of Biological Sciences since the time of his appointment has run out. The Corresponding Member of the Academy of Sciences of USSR, N. M. Sisakian, was chosen as an acting Academician-Secretary of OBN [Department of Biological Sciences].

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Litvinenko, S. N.

K voprosu ob izuchenii rostovykh
stimulatorov-gibberellinov

[On the study of growth substances-
the gibberellins]

Botanicheskii Zhurnal [Moskva] vol. 44,
no. 5, p.645-647. May, 1959. 451 R923

(In Russian)

During the course of the last twenty years the researchers show great interest to the new, very active group of growth substances-gibberellins.

The history of discovery of gibberellins is connected with the study of disease of the "bad shoots" or "bakanae" on rice, consisting of an extreme elongation of seedlings, which, on the whole, leads to weakening and death of plants. A fungus Gibberella fujikuroi - the pubescent stage of Fusarium moniliforme turned out to be the pathogen of the disease. Jabuta and Hayashi (1939) obtained an active substance, which was called gibberellin in the name of the pathogen of the disease from secretions of this fungus.

Later on, Stodola and his co-workers (in 1955) obtained gibberellic acid by a fermenting method, on an artificial medium.

Botanicheskii Sad Akademii Nauk Ukrainskoi SSR, Kiev [Botanical Garden of the Academy of Science of the Ukrainian SSR, Kiev].

Gibberellins proved to be substances of extremely high physiological activity. The water solution of gibberellin, in dilution 1 : 1,000,000, speeds up the growth and development of plants by many times: beans, peas, corn, pepper, tobacco, millets, tomatoes, soybeans, and so on.

The history of discovery, production and study of gibberellins is set forth with much detail in the reference journal "Khimicheskie sredstva zashchity rastenii" [Chemical means for plant protection] (1958).

A group of Soviet scientists, headed by Professor M. Kh. Chailakhian conducts an important work with gibberellins, that were received from USA. Results of their research are interesting and convincing: gibberellins speed up the growth and development of plants, especially of annuals; speed up flowering and fruiting; break up the period of rest in seeds (Chailakhian, 1957, 1958a, 1958b).

Significant are the experiments of Czechoslovakian physiologists Ia. Krekule and A. Martinovskaja (1958), who confirmed the positive effect of gibberellic acid on the development of wheat and millet. These authors worked with growth substances that were sent in from England.

N. A. Krasil'nikov (1958) obtained and tested a preparation very similar in effect to gibberellin.

In 1958 in Kiev, V. I. Bilai (Institute of Microbiology of the Academy of Science of Ukrainian SSR and D. A. Verner (Institute of

Organic Chemistry of the Academy of Science of Ukrainian SSR) obtained for the first time in the Ukraine the crystallized gibberellin.

We started the work on studies of the effect of the native gibberellin on the growth and development of plants in the Botanical Garden of the Academy of Science of the Ukrainian SSR. Our first problem was to satisfy ourselves of the physiological activity of the newly obtained substance.

Therefore the conducted experiment bore a doubly reconnoitering character.

The following plants were taken for treatment with the growth substance: aromatic tobacco (Nicotiana odorata) and Chinese aster (Callistephus sinensis) - plants of a short day; gentian (Gentiana crassicaulis) and sea lavender (Limonium girardianum) - plants of a long day; privet (Ligustrum vulgare) and Pyracantha coccinea - shrubs.

The grass plants were taken when week-old, in a phase of two true leaves, and the shrubs - in a phase of two seminal leaves.

Part of plants of each kind were treated each day with the water solution of gibberellin in a concentration of 0.0025%. The control plants received water instead of the gibberellin solution. The plants were treated according to the method applied by M. Kh. Chailakhian; that is, the solution of the growing substance was daily applied with a pipette, one drop to the point of growth.

The experiment was started on June 26, 1958. All the plants were kept in a hothouse.

At the end of the first week of treatment it became apparent, that the experimental plants Calistephus sinensis and Nicotiana odorata overtake the control plants in growth and development.

[Begin p.646] If the control plants had at this time 2-3 rosette leaves, then in plants, treated with gibberellin, the stem started to develop.

In plants of the long day (Gentiana and Limonium) no any difference was noted between the experimental and control specimens during this period. The same was observed also in the shrubs (Ligustrum and Pyracantha).

At the end of the second week since the beginning of the treatment the results of the effect of growth substances became apparent especially prominently in Nicotiana odorata: the control plants were yet in the phase of the rosette, while those treated with gibberellin had a stem 7-10 cm high with a mass of flower buds at the top. The leaf blades of experimental plants were larger, wider, their petioles longer than in the control plants.

Title of figure 1. Nicotiana odorata at the end of the 5th week since the beginning of the experiment. At the left - the control plant; at the right - the one treated with 0.0025% gibberellin solution.

Title of figure 2. Calistephus sinensis at the end of the 4th week since the beginning of the experiment. At the left is the control plant; at the right - the one treated with the 0.0025% gibberellin solution.

At the end of the 4th week, that is 28 days after the beginning

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of the experiment, the tobacco plants began to bloom, having a stem 15-20 cm long. The control plants still remained in the phase of a rosette.

One should point out, that the difference in concentrations of gibberellin solutions (0.0025 and 0.025%) did not reflect on the tempos of growth and development of tobacco: plants of both variants almost did not differ one from the other. The plants of tobacco are shown in figure 1 at the end of the 5th week since the beginning of the experiment. The plants of the Chinese aster developed approximately at the same tempo as the tobacco plants, and started blooming at the end of the 4th week (Figure 2).

Plants of the long day proved to be insensible to growth substances: during the course of 7 weeks no difference was observed in the growth and development of experimental and control plants.

As to the shrub plants, gibberellin produced a noticeable effect on them: in both variants of treatment at the end of the 4th week the plants attained a height of 10-12 cm and had 8-10 true leaves, while the control plants were only 3.5 cm high and had only 2 true leaves (figure 3). [Begin p.647]

Title of figure 3. Ligustrum vulgare at the end of the 4th week since the beginning of the experiment. At the left - the control plant; at the right - the one treated with a 0.0025% solution of gibberellin.

Our small preliminary experiment indicated, that gibberellin, obtained by the Ukrainian researchers proved to be a highly active growth substance.

The technology for obtaining gibberelin from native strains of Gibberella fujikuroi, which is being developed by V. I. Bilal and D. A. Verner, will permit to organize the production of this growth substance at the Kiev factory of bacterial fertilizers of the Agricultural Ministry of the Ukrainian SSR.

Further work on studies of gibberellin effect on plants can be developed according to the following basic directions:

a) checking the effect of gibberellins on the widest possible collection of plants - herbaceous (with a differing photoperiodic reaction), shrubs and trees, in order to study the stimulation of the increase of the vegetative mass and speeding up of flowering and fruiting (for instance, obtaining seeds of biennials during the first year);

b) studies of the effect of gibberellin on the size of the period of rest, especially in seeds of tree varieties that are hard to sprout;

c) studies of influence of gibberellin treatment for the rooting of tree cuttings; especially of the hard to root forest and fruit varieties;

d) as a particular case for speeding up the growth, it is necessary to study the possibility of preparing the wildlings of fruit varieties for grafting during one year instead of two, as it usually takes place in nurseries;

e) testing of gibberellins for treatment (spraying) of fruit trees during the period of flowering in order to reduce the shat-

tering of ovaries;

f) studies of the required high agrotechnical background for treated plants, which are developing in accelerated tempos;

g) comparative studies of the effect of gibberellins and auxins on the plants;

h) examination of the mechanism of the effect of gibberellins on the mechanism of plants;

i) studies of the most favorable doses and best methods of treatment of various plants;

j) indispensable testing of growth substances on all the above points under production conditions along with the experimental.

Such is the far from full enumeration of questions and problems, that arise in serious and deep study of gibberellins.

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Razumov, V. I., and Limar', R. S.

Gibberellin i vozmozhnosti ego ispol'zovaniia v rastenievodstve

[Gibberellin and the possibilities for its utilization in plant growing]

Vestnik Sel'skokhoziaistvennoi Nauki, vol. 4, no. 9, p.68-78. September, 1959. 20 V633

(In Russian)

A substance, producing an unusually strong effect on plants, was discovered in Japan over thirty years ago; it is secreted by a fungus Gibberella fujikuroi, parasitizing on rice. Later on (in 1939) this substance was isolated in a crystalline form; in connection with this a wide possibility arose for examining its effect on many physiological functions of plant organisms. Nevertheless, it was only during the last 3-4 years, in different countries of the world, that wide research on this preparation. was unfolded. The obtained results turned out to be unexpected and striking. It was found out that gibberellin not only stimulates the division and growth of plant cells, speeding up the growth of different organs of plants, it also disturbs the state of rest in seeds and tubers, as well as accelerates the development of certain plants. It is quite apparent that the research on the effect of gibberellin on the plant organism will permit to

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study the life of plants deeper. It is assumed, along with this, that with the aid of gibberellin it will be possible to increase the yielding capacity of certain agricultural plants.

Inasmuch as gibberellin is produced by a parasitic fungus, one can assume that this substance is foreign to the plant and its reaction must be regarded as purely pathological. Yet, at the present time one can hardly consider such an opinion as well-grounded. The matter is that research of microbiologists has ascertained the presence of fungi and yeasts which secrete gibberellin-like substances (2) in the soil near the root system. Apparently these substances can be absorbed by the root system and enter the plant tissues. And what is more, in the developing seeds of beans (13, 35) and of certain pumpkin plants (30) a substance was discovered which is similar in its physiological effect to gibberellin. All this compels one to think that gibberellin is a substance that is not foreign to plants. On the contrary it, probably, takes part in several important physiological processes. Otherwise it would be difficult to understand the causes, owing to which gibberellin is able to influence such diverse and crucial processes of the metabolic activity of plants.

The present report has as its aim to throw light briefly upon certain results, obtained in the experiments on the use of gibberellin, chiefly by foreign researchers.

METHOD OF REACTION OF GIBBERELLIN ON THE PLANT

Fungus Gibberella fujikuroi secretes into the medium, in which it is cultivated, at least three substances: Gibberellin A₁, Gibberellin A₂ and gibberellic acid. The later one is the most active physiologically, although all the three substances are alike in their effect. They dissolve well in alcohol and water and, therefore, water solutions are usually used for reaction upon a plant. [Begin p.69] The method for introduction of gibberellin is very simple. It is either introduced into the soil in large concentrations, since a considerable part of it is absorbed by the soil, or is applied directly to the plants; this is done much more often.

The means for influencing the plants with gibberellin are different. They come to the following methods: 1) application of a drop of solution (mixed with a moistener) on the top or side bud; 2) application of gibberellin in lanolin to the bud; 3) spraying of the plant, most often of the top bud and nearby leaves; 4) dipping of leaves with a removed tip (for a better absorption) into a solution of gibberellin or submerging of tubers and seeds into a solution of the preparation; 5) injection of the solution into the stem of the experimental plant with the aid of an injector. In field experiments only the spraying of plants from a sprayer is practicable.

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Concentrations of the solution differ, depending on the crop and the purpose that the researcher has in mind. Weak concentrations (10-100 mg per 1 L) with a single or double reaction produce stimulation of the growth of stems and leaves. A daily treatment during the course of 30-50 days with a solution, containing about 200-1,000 mg of gibberellin per 1 L, is required in order to make some biennial plants bloom during the first year of planting. In order to increase the percent of setting of fruit in aurantiaceae the solution of 250-1,000 mg per 1 L is active, while in respect of grapes, for the same purposes, just 5-100 mg per 1 L are sufficient. A still smaller concentration of the solution is sufficient for a change of morphology of an ivy leaf or for increasing the petals in the geranium flower (10 mg per liter). Effectiveness of utilization of gibberellin depends greatly on the age of the plant. The treatment of plants at an early age is much more effective.

Let us examine briefly those reactions of plants, which can be produced by the use of gibberellin.

Elongation of the stem is the most characteristic reaction of plants to the use of gibberellin. Marth (36) describes the results of research that was conducted with 49 different plants. All of them reacted to gibberellin with the lengthening of the stem. Certain kinds (beans, aurantiaceae seedlings, tomatoes) increased the length of the stem by 3-6 times, while others (spruce, pine tree, gladioli) very insignificantly. Very interesting research is described with

genetically dwarf plants (mutants) of peas (10), maize (42), tomatoes (44). Dwarf plants attained to size of normal plants as a result of treatment. It is true, the reaction of plants was not fully unanimous. From among 6 corn plants four reacted positively, while two other plants remained dwarfs.

One can force, with the aid of gibberellin, the bushy forms of beans to produce winding stems, which increase their length by several times as compared to the control. In one of such experiments (50) the height of the control plants was 27 cm, while of the experimental - 112 cm. The same reaction is peculiar also to seedlings of tree varieties; thus, for instance, eucalyptuses, in the control, had a length of 12 cm, while those treated with gibberellin - 47 cm (49).

One can influence both the vegetating plants as well as the seeds for the stimulation of the stem growth. The plants of dwarf peas (37), grown from seeds that were soaked in a gibberellin solution, increased their growth when compared with the control plants. [Begin p.70]

The rate of reaction to the treatment with gibberellin is determined to a considerable degree by the condition of plant growing. Thus, in peas the height of stems, in growing them under conditions of a 9-hour day (when usually the growth is inhibited) increased more intensely, under the effect of gibberellin, than of those cultivated during the long, 18-hour day (54). Observations of several researchers of the growth of plants that were treated with gibberellin and grown at reduced temperatures (10-13°),

which are unfavorable for the growth, are quite substantial. It proved to be, that gibberellin as if widened the temperature range of growth. The forage grasses, treated in the early spring, began to grow actively, while on the control sections no growth was discovered yet. The treatment of seeds of peas and beans with gibberellin, and their planting at reduced temperature, speeds up the appearance of sprouts very much (54). If these observations will be confirmed on a large number of crops, then a possibility will arise for obtaining early young growths after early plantings, which will be important for the control of weeds and for widening of the range of the vegetation period.

Spreading out of leaves. The size and number of leaves usually increased along with the elongation of the stem under the influence of the gibberellin treatment of plants. Thus, as a result of treatment, the leaves of cucumbers covered an area of 12.1, while the control - 9.2 units (26). Similar observations were conducted on potatoes (23), barley (27) and other plants. Increase of the size of the leaf area was also recorded in the work with cuts of leaves that were floating over the solution of gibberellin or water (27).

Often there was no increase in weight of leaves during the increase of the leaf area, as they became thinner, the contents of chlorophyll in them becoming reduced. No intensification of the process of synthesis was noted in leaves that were treated with gibberellin (23, 21).

Several of the researchers mention that the increase of leaf area was recorded in far from all plants under the effect of gibberellin. Sometimes the gibberellin treatment led to sharp changes in the morphology of the leaves. The leaves of tomatoes changed from complex to simple ones (45). In the work of Robbins (47) a branch of the adult ivy plant, having mature leaves, after treatment with gibberellin (10 mg per 1 L), produced a shoot, which was strongly colored with anthocyan and bore leaves with three lobules: such leaves are characteristic for the juvenile phase of ivy development. Crescent-lanceolate leaves, characteristic for adult trees (49), formed on one-year seedlings of eucalyptus under the effect of gibberellin treatment (100 mg per 1 L).

As we see, one and the same preparation produces a different effect on plants, causing on some the appearance of juvenile forms of leaves on adult plants, while in others - formation of leaves, characteristic for adult trees, on seedlings.

Changes of other organs of plants. Under the influence of flower buds in certain plants - geranium (54), ground ivy (43) - the size of the corolla can increase at the expense of the growth of petals. In cucumbers (54), treated with gibberellin and growing on a soil, well fertilized with nitrogen, the number of male flowers, preceding the formation of the female flower, increases. A sterility of male flowers is produced (39) in corn plants after treatment of immature inflorescences, the size of 6-7 cm, with gibberellin (1,000 mg per 1 L).

Treatment of plants with gibberellin leads not alone to spreading out - elongation of the already existing cells, but it also increases the speed [Begin p.71] of division of meristematic cells of the cambigenetic zone (9). It is interesting to mention in connection with this, that the tissues of the callus of the carrot, cultivated on an artificial nutrient medium, grew more intensely in the case when gibberellin was added to the medium (7). Addition of gibberellin to nutrient media is used for cultivation of plant tissues (40), for growing embryos removed from seeds (20), for germination of ripe pollen (15) and its development in isolated anthers, beginning with the stage of maternal cells of microspores to the formation of tetrads (51).

Gibberellin stimulated, in most cases, the growth and development of the studied objects. n

TREATMENT WITH GIBBERELLIN AND YIELD OF PLANTS

If, as a result of treatment of plants with gibberellin, the growth of stems and leaves was stimulated, did this cause an increase of dry weight of these plants every time? Results of research give a contradictory answer to this question. Stimulation of growth and, at the same time of yield, depends in many ^spects on the choice of the correct dose of treatment and on the provision of plants with the flow of nutrient substances. In the experiments with beans (50) the dry weight of control plants comprised 2 g, of

those treated every 5 days with gibberellin (50 mg per 1 L) - 2.1 g, and of those treated daily - only 1.5 g.

Several authors observed an increase in the yield of vegetative mass of forage grasses as a result of treatment of plants with gibberellin, particularly in meadow grass (17, 24, 31, 38). It is possible to increase the yield of the first mowing of grasses 1.5-2 times (31) by combining the treatment of plants with gibberellin (277 g per 1 ha) with fertilizers. The following mowings can be high also after a repeated treatments. If one does not do that, then the yield will be lower than on the control sections (38). Nevertheless the rate of the yield of forage grasses depends on the combination of doses and dates of treatment with gibberellin with dates of harvests and introduction of top dressings. Whereupon the question remains : unsolved about the ability for overwintering of grasses, which were treated with gibberellin during the summer. There is a reason to suppose that the ability for overwintering of forage grasses will be strongly reduced after repeated treatments with gibberellin.

In the work of Wittwer (54) it is reported about the increase in yield of several vegetable crops (celery, tomatoes, peas, beans) as a result of their treatment with gibberellin.

Information about potatoes is contradictory. There are reports of both the positive (23) as well as negative (24) effect of treatment of potato plants with gibberellin on the yield of tubers.

Data, obtained in the Laboratory of Physiology of the All-Union Institute of Plant Industry, in 1958, in experiments with the wild variety of potatoes S. demissum, show that treatment of plants with weak solutions of gibberellin leads to a reduction of yield of tubers. Moreover, the higher the concentration of the solution was used the more was the weight of the tubers reduced. Potatoes were grown at a 12-hour day (table 1).

According to data of foreign authors, experiments with corn, sugar beets, barley, rye, and wheat (for grains) did not produce any expected increase in yield. Nevertheless, this does not yet form a basis for a categorical [Begin p.72] conclusion. (Text continued after table 1)

Table 1

Effect of gibberellin on the growth and tuber formation of potato plants of the wild variety S. demissum

Concentration of gibberellin*	Height (cm)	Dry weight (g)		Dry weight of tubers (g)
		stems	leaves	
0	15	0.64	2.0	16.4
0.1 mg/L	15	0.59	2.02	15.3
1 "	16	0.47	1.22	13.9
10 "	20	0.62	1.25	11.1
100 "	29	0.75	1.20	8.4

*Spraying was conducted 7 times in every two days.

Corn reacted positively to the treatment with gibberellin in experiments of I. V. Mosolov (3); the yield of ears in the experiment proved to be by 143% higher than in the control; the yield of green mass of clover after treatment with gibberellin increased by 150%.

Quite definite results were obtained on several crops in treating flowers and fruits at the beginning of their formation.

L. Rappaport (45) treated floral racemes of tomatoes with a solution of gibberellin (1 mg per 1 L) and obtained 14 fruits on a plant, while on the control plant there were only three. A. Persson and L. Rappaport (41) conducted experiments with tomatoes, which had sterile pollen. There were 0.7 specimens of parthenocarpic fruits that set ⁱⁿ the control, while after spraying with gibberellin (500 mg per 1 L) there were 15 specimens per plant. Effectiveness of treatment with gibberellin for obtaining parthenocarpic fruits in tomatoes is indisputable. At the same time while quantitatively the yield increased, nevertheless, the size of fruits of experimental plants was somewhat smaller than of the usual fruits.

Treatment of flowers of pears and figs with gibberellin (25-100 mg per 1 L) gave very noticeable increase in the number of fruits. The treatment with gibberellin (250-1,000 mg per 1 L) was very effective in the sense of increase of the number of fruits of lemons, tangerines and oranges. Spraying of almost ripe fruits of the aurantiaceae leads to the increase in them of vitamin C. The most astonishing conclusions, as the result of treatment with gibberellin, were obtained on fruits of grapes; this is seen from the work of Weaver (52) after treatment of flowers and of fruit, which were just set, of the seedless variety "Korinka chernaia" [Black currants] with the solution of potassium salt of gibberellic acid (table 2).

Table 2.

Effect of gibberellin on the weight of berries and bunches of grapes

Indices	Control (without treatment)	Treatment with gibberellin		
		1 mg/l	20 mg/l	500 mg/l
Weight of a berry	0.26	0.47	0.78	1.31
Weight of a bunch	91.6	206.5	366.6	500.7

[Begin p.73]

Title of figure 1. Bunches of grapes, variety Black currant: A - of the untreated control plant; B - ringed, but untreated with gibberellin; C - without ringing but treated with the solution of gibberellin (5 mg per 1 L); D - without ringing but treated with the solution of gibberellin (20 mg per liter)

As it is seen from the table, the weight of the fruit and of the bunch increased by 5 times when compared with the control (figure 1). Correspondingly the yield of grapes increased from each bush. Falling off of fruit is absent after treatment, the bunch forms more loosely and this reduces diseases. About the same result was obtained with varieties that have seeds.

One can conclude from the above cited that the yield of certain agricultural plants can be influenced by means of gibberellin.

BREAKING THE REST PERIOD OF SEEDS AND BUDS WITH THE AID OF GIBBERELLIN

During the progress of selection work, and sometimes under conditions of agricultural production it is sometimes necessary to use for planting the newly gathered seeds or tubers, which are as yet in a state of rest. Nevertheless, the recommended methods for breaking the state of rest are not sufficiently effective.

(13)

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L. Rappaport, with co-authors (46), working in California aimed at receiving two yields of potatoes per year; for this purpose the second planting was done with the newly harvested tubers. Gibberellin was utilized for the overcoming of the period of rest. Tubers, which were submerged for 5 minutes into the solution (500 mg of the preparation per 1 L), germinated uniformly and fast, whereupon all the eyes, present on the tuber, sprouted; this led to the formation of multiple-stemmed bushes of potatoes (figure 2). In the work, carried out in Netherlands in the city of Wageningen (19), nine different varieties of potatoes were tested. A fast and uniform sprouting was recorded for tubers treated with gibberellin. In the Laboratory of Physiology [Begin p.74] of Plants of the All-Union Institute of Plant Industry (Ts.M. Khashes) newly harvested tubers of eight different varieties were sprouted. Tubers were selected with a different length of the period of rest - from 35 to 112 days. On the 20th day after treatment with gibberellin (solution in water 0.004%, length 30 minutes) all the potato varieties had sprouts of from 1 to 6 cm. Varieties with a long period of rest had thicker and stronger sprouts than the varieties with a shorter period of rest (table 3).

Title of figure 2. Sprouting of potato tubers, Kathadin variety: on the left - untreated tuber, on the right - gibberellin treated.

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Table 3

Speed of sprouting of newly harvested potato tubers after their treatment with gibberellin

Varieties	Length of the period of rest (days)	Size of the sprout (mm) after treatment on	
		6th day	12th day
Arran Banner	112	12	35
Arran Consul	112	12	60
Majestic	112	5	40
Brigitta	110	4	47
Britta	63	1	15
Lorch	59	3	13
Erstling	56	3	6
Eigenheimer	35	10	16

The conducting, in southern regions of USSR, of comparative test by planting two-harvest varieties of potatoes and of the newly-harvested tubers of common varieties, treated with gibberellin, was of unquestionable interest.

It is possible to use a gibberellin treatment of female plants before harvesting the yield in order to break the period of rest in potato tubers. According to the report of L. Lippert (32), the treatment of plants with gibberellin (500 mg per liter), 4 weeks before harvesting gave better results.

In certain cases the possibility for obtaining misshapen tubers is not excluded after gibberellin treatment of potato plants. Sprouting of most of the eyes on the already formed tubers occurs under female bushes. The eyes that started growing do not form a sprout, but a stolon, which carries a young tuber. As a result of this a mass of young daughter tubers are produced (figure 3). Conditions, under which such deformities occur, are not ascertained.

It is supposed (32) that this occurs in using gibberellin in a concentration 10 mg per 1 L. Data of experiments, conducted in the Laboratory of Physiology of the All-Union Institute of Plant Industry, show that the time of treatment is of great importance in obtaining of such malformations. If the treatment of plants is conducted during the period of the beginning of formation of tubers, then the deformities occur, while a later treatment (10 days after the end of blooming) does not produce any misshapen tubers.

[Begin p.75]

Title of figure 3. Character of tuber sprouting in the soil after foliar application of gibberellin to female plants.

Gibberellin treatment for the purpose of breaking the rest period is applicable not only to potatoes, but also to the buds of many tree and fruit varieties. It is known that peach plants, after leaf fall, require a temperature $+7^{\circ}$ during the course of not less than 27 days, since without this cooling the leaf buds cannot open normally. In growing the plants, which lost their leaves, in warmth, it was succeeded to compel the resting buds to start growing by treating them once with a gibberellin solution (4,000 mg per 1 L). But, if the peaches have already obtained a certain cooling (18 days out of the required 27), then a weaker concentration of gibberellin - 10 mg per 1 L - can be active. The author makes a conclusion about the possibility of growing peach trees, using gibberellin, in more southern, warmer regions, where

they are not cultivated now. Clear results were obtained in experiments with Japanese camellia (33) and pine (Pinus elliotti - 8), which, when grown at a short day, very soon enter a deep rest. This rest period can be broken, without changing the length of day, by treating the plants with a gibberellin solution.

Experiments with tree peony (6) proved to be successful. It requires temperature of 1-10° during the course of at least 3 months for its sprouting. It was possible to break the state of rest, excluding the cooling, but treating these plants with gibberellin (100 mg per liter). Experiments are known of overcoming the rest in seeds of many crops. Seeds of apple (Malus Arnoldiana) require stratification during the course of 30 days. They can sprout also without stratification, but in this case the seedlings produce a rosette form. Gibberellin treatment (10 mg per 1 L) provides an active growth of the stem in height without the stratification of seeds (5). Lettuce seeds sprout better in the light and badly in darkness, but they germinate well in darkness after a gibberellin treatment of 100 mg per 1 L (25).

G. Shamsiev, in the Laboratory of Plant Physiology of the All-Union Institute of Plant Industry, conducted experiments with barley varieties, which possess a well expressed period of after-harvest ripening. The seeds were harvested and sprouted during different phases of ripeness, as well as were sprouted after different periods of their storage. The age of seeds was figured from the moment of their heading. The seeds were grown in Petri dishes

over filter paper, which was moistened with water (control) or gibberellin solutions of 200 mg and 20 mg per liter.

Dependence of the speed of seed germination on their age was clearly shown in the control. Sprouting of seeds on gibberellin solutions occurred very quickly, but in this case also the speed of their sprouting depended on the age of the seeds. Gibberellin cannot produce a uniform sprouting of barley seeds, which were harvested from plants on the 31-48 and [Begin p.76] even on the 101 day after heading. Such seeds are not ready for sprouting in their physiological state and their treatment with gibberellin cannot produce full germination. Besides that, the seeds of the same variety of barley were sprouted over water and gibberellin solution (0.2%) at a temperature of 10° and 20°. The newly harvested seeds sprouted more uniformly in the control at 10°. It is known that the reduced temperature is favorable for the germination of seeds that are in a state of after-harvest ripening. The same dependence on the temperature was retained also in sprouting the seeds over the gibberellin solution. Consequently, in this case also, gibberellin did not substitute fully those conditions which are favorable for the sprouting of newly harvested seeds, but only speeded up the process of germination.

Acceleration of the development of plants with the use of gibberellin has been mentioned by many researchers. The American scientist, A. Lang (29), in 1956, caused a flowering in plants of the winter race of henbane under conditions of increased temperature. The same results were obtained with the early variety of carrots

(29), with campanula (14), endive (22), arabidopsis (48). It appeared that gibberellin possesses one more physiological characteristic - to replace vernalization of plants. Nevertheless, this is far from being so as the subsequent research has shown. All the attempts to force the typical winter ryes and wheats (28) or the biennial plants of sugar beets, which acquired a great "extent of winter crop qualities" ["stepen' ozimosti"] (16) to form spikes with the aid of gibberellin proved to be without results.

The report of Wittwer (53) merits attention; he treated the plants of cabbage, of turnips, rutabaga and other biennial plants with gibberellin at a temperature of 10-13° and 18°. The flowering of experimental plants was noted at 10°, but no flowering was observed at the temperature of 18° notwithstanding the strong elongation of stems of plants that were treated with gibberellin. In a later work (54) Wittwer points out that it is absolutely necessary to grow them at a reduced temperature (10°) in order to compel the biennial plants to flower under the effect of gibberellin. Apparently, gibberellin itself cannot replace vernalization, but it can speed it up under such conditions when the process proceeds very slowly.

The results are approximately the same from the use of gibberellin in respect to plants of a long day. If such plants are grown at a short day, they do not flower and do not form spikes. Flowering of certain plants of this group is possible under conditions of a short day with a gibberellin treatment. Such results

were obtained on plants of spring henbane (28), catchfly, nipplewort (28), coneflower (Rudbeckia) (4, 12), poppy (34). Spring rye (28), oats, cornflower, chamomile (Acthusa Cynapium - 34) and others do not react to gibberellin treatment and remain in a vegetative state under conditions of a short day.

As it is seen from all the above said, plants of a long day behave differently after a gibberellin treatment. One should point out, that all the plants of a short day do not accelerate development if they are treated with gibberellin and are grown under conditions of a long day.

Regardless of the opinion of certain authors (11), the acceleration of development of plants is by no means a general reaction under the effect of gibberellin. Only a small number of plants, in growing them at a certain length of the day (a little below than the critical length of the day), can respond to the gibberellin treatment by an acceleration of flowering.

One can make the following conclusion by summing up the above cited: gibberellin is a physiologically active substance, which influences a series of very important physiological processes. In this respect the research [Begin p.77] on the use of gibberellin presents a great scientific interest, since it opens up possibilities for penetrating deeper and perceiving many crucial processes in the life of plants. At the same time some possibilities open up in the use of gibberellin also for the purpose of its practical use in plant industry. Nevertheless, it is necessary.

in this direction to conduct research for establishing exact doses in gibberellin treatments and of those conditions of growing, which can produce the desired effect.

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Damanskaya, L. Iu.

Sredstvo protiv gallevoi nematody

[Means for control of root-knot eel-worm
(*Heterodera radicicola*)]

Zashchita Rastenii, vol. 4, no. 6, p.41.
Nov./Dec. 1959. 421 21

(In Russian)

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Of late new preparations are successfully used for the control of root-knot eel-worm; among these "Vapam" is widely advertised. It is known as a soil fumigant, that possesses fungicidal insecticidal, herbicidal and nematocidal characteristics. It was used in USA and in Holland for the control of citrus and potato nematodes in its latter capacity. This preparation is the sodium salt of methyldithiocarbamic acid $\text{CH}_3\text{NHC} \begin{smallmatrix} \swarrow \text{SNa} \\ \searrow \text{S} \end{smallmatrix}$), with specific gravity 1,233 and active element of 52% (USSR) and 31% (of imported production). It is a liquid of yellow color, smelling like herring, causing irritation and burns when it touches the skin; it is used in the form of a water solution and after introduction into the soil is adsorbed quickly by its particles. Methylisothiocyanite and several other substances are products of its decomposition. It acts as a nematocide strictly locally in the place of introduction.

In 1958, Mosstazra [Moscow Plant Protection Station] conducted tests of "Vapam", of native make, in a Moscow suburbun

vegetable sovkhos "Imeni M. Gor'kii" on a crop of tomatoes. Two basic problems were proved: the effectiveness of the action on the nematode and the phytocidal character. The preparation was introduced by two methods: by surface watering with a following digging over and smoothing of the soil or by an injection through an injector to the depth of 12-15 cm with a following covering over of the openings and rolling of the soil. In the first case doses were tested from 10 to 50 g per 1 m² and in different concentrations of water solutions; in the second case - from 20 to 40 g/m² in a dilution of 2 L of water.

In the first series of experiments the soil was dug over a week later in order to let out the accumulated gases. Tomato seedlings of the variety "Luchshii iz vsekh" [The best of all] was set out 28 days after treatment of the soil. Tomatoes took root and developed normally in all the series and variants of the experiment. Taking of stock was conducted two months after the beginning of the experiments. Phytocidal characteristics of "Vapam" were taken into consideration only by way of comparing the growth of stems of plants and the general trend of development of the crop. The content of products of "Vapam" in the plant was not examined.

The obtained results have shown that the preparation is effective in doses from 20 to 50 g/m² and does not produce any visible pathological changes in plants in the process of their growth and development.

Kuchaeva, A. G.

Primenenie antibiotikov protiv nasekomykh -
vreditel' rastenii

[Use of antibiotics against insect pests of
plants]

Vestnik Sel'skokhoziaistvennoi Nauki, vol. 4,
no. 7, p.138-140. July 1959. 20 V633

(In Russian)

The microbiological method for plant protection was first proposed and tested in our country by I. I. Mechnikov 80 years ago; in the control of the grain beetle, Mechnikov suggested utilizing the microbes Bacillus salutarium and Metarhizium anisopliae that are pathogenic for this beetle.

In subsequent years many Soviet as well as foreign investigators demonstrated the desirability of using biological measures in the control of injurious insects. Attempts to use microorganisms in insect control did not, however, always culminate in the desired results, because the biological and ecological bases of the problem were not fully developed.

At the present time there arises the question as to the use of antibiotics in the control of plant pests. We have investigated this problem on the gypsy moth Porthetria dispar L. which inflicts great losses on agricultural and forestry economics.

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In mass propagation, the caterpillars of the gypsy moth eat the foliage of plantings which leads to a loss of the annual increment and the drying up of trees. The gypsy moth eats the leaves of more than 100 plant species. The more susceptible species are oak, apple trees, maple, mountain ash and others.

In a search for antibiotics that would produce a deadly effect upon the gypsy moth, we in the fall of 1957 collected its ovipositors that were kept in a refrigerator at a 2°-4° temperature [t°]. In the winter of 1957/58, caterpillars were developed under laboratory conditions and, in so doing, it was established that they ate the leaves of oak and of mountain ash best of all. We selected these plants for further work.

To test antibiotic action exerted upon caterpillar of the gypsy moth, we took 34 antibiotic preparations of actinomycete, bacterial, fungal and synthetic origin. In table 1 are cited the characteristics and some properties of these preparations.

The antibiotic substances undergoing tests were placed for 12 hours in containers in the form of solutions of each antibiotic separately in a concentration of 80-100 units/ml. Cuttings of plants were placed in the containers with antibiotic solutions. The [degree of] antibiotic penetration [Begin p.139] into a plant was calculated by the method which we described earlier - a crushed mass of leaves was placed onto the plate [gazon - a lawn] of the test-culture Staphylococcus aureus 209. The experimental results were estimated after 12-18 hours by the presence or absence

(3)

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of a depression zone of the test culture encircling the cluster of crushed leaves.

Table 1.

Characterization of antibiotic preparations used in tests

Name of preparation	Name of the preparation producer	Action of preparation in unit solutions for Staph. aureus (mg/ml)	Source of preparation
Blomycin	Act. aureofaciens	1 000 000	Preparations available for sale Moscow
Syntomycin	Synthetic preparation	1000	Same
Levomycetin	Act. venezuelae	729	"
Penicillin	Penicillium notatum	2400	"
Streptomycin	Act. globisporus	2800	"
Terramycin	Act. rimosus	800 000	All-Union Sc.-Res. Inst. of Antibiotics, Moscow
Phytobacteriomycin	Act. lavendulae 696	1200	Same
Grisemin	Act. griseus 15	729	Inst. of Epidemiology and Microbiology im. Gamaleia. Moscow
Chloromycetin	Act. venezuelae	729	Laborat. of Minist. for Food Indust. Peking
Erythromycin	Act. erythreus	729	National Inst. of Med. Research. London
Tetracyclin (Achromycin)	Act. rimosus	2400	Same
Chloroamphenicol	Act. venezuelae	1000	"
Viomycin	Act. puniceus var. floridae	1200	"
Polymyxin	Bacil. polymyxa	27	"
Bacitracin	Bacil. subtilus	81	"
Usnic acid	Lichen	27	Botan. Inst. Acad. Scien. USSR, Leningrad
Actinomycin 76	Act. globisporus	10 000	Inst. of Microbiology, Acad. Scien. USSR, Krasil'nikov Lab.
" 2703	Act. globisporus fluorescens	2800	Same
Preparation 070	Act. globisporus vulgaris	243	"

[Table continued on next page]

[Table 1 continued from page 3]

Name of preparation	Name of the preparation producer	Action of preparation in unit solutions for Staph. aureus (mg/ml)	Source of preparation
Preparation 1149	Act. aurantiacus	1200	Inst. of Microbiology, Acad. Scien. USSR, Krasil'nikov Lab.
Preparation 1706, 1916, 2739	Act. griseus	80-1800	Same
Preparation 119, 194, 719, 829, 1205, 1775	Act. violaceus	1000-10000	"
Preparation 77, R-42	Act. rimosus	1200-1800	"
Preparation 592, 1040	Act. globisporus	270	"
Preparation WKS	Act. Lavendulae	2100	"

As a result of analyses it has been clarified that most of the antibiotic preparations penetrated into the leaves of oak and mountain ash and were found there for a period of 7 days. Those that failed to penetrate leaves were Actinomycin 76, the preparations 070, 1205, 719, 829, 2739 and usnic acid. The ones that proved toxic for plants were biomycin, terramycin, preparation 2703, and in part grisilin: they cause wilt or loss of leaf turgor.

The antibiotic preparations that were not absorbed by plants from the solution were applied to the leaf surface by spraying the same concentrations. Plants thus treated remained normal the same as control plants.

During the following stage of our work we tried to elucidate the influence of the antibiotic substances introduced into plants

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[Begin p.140] upon the development of gypsy moth caterpillars. We set up these experiments as follows: just as soon as the gypsy moth caterpillars were brought out of the eggs, they were transferred (15-20 specimens) to a breeding place with oak leaves treated with antibiotics. The behavior and development of the caterpillars was under observation for 20-25 days. During the entire experiment oak twigs were changed as the caterpillar ate up the leaves, and every time the [twigs] were treated with the appropriate antibiotics.

The experiment has demonstrated that according to the action exerted upon the caterpillars, the antibiotic substances can be divided into 4 groups (table 2): the first group includes the antibiotics that do not exert any notable influence upon the development of caterpillars; the second group - those exerting inhibitive action upon the development of gypsy moths, the caterpillars moved with difficulty, were sluggish, ate the leaves passively and, toward the end of the observation, lagged in growth behind controls (controls 4-6 cm, experimental 2-3 cm). But all 135 caterpillars were alive. The third group includes antibiotics that exert stimulating action upon caterpillars. The caterpillars that were given such antibiotics moved around, ate the oak leaves quicker than those in control, and in size they surpassed somewhat control caterpillars.

The fourth group includes antibiotics that exert deadly action upon caterpillars of the gypsy moth. These are preparation 2703 which killed on the average 35% of caterpillars by the 8th day, actinomycin 76 which destroyed 46%; 73% of caterpillars died from preparation 1205

[and] the native liquids 119, 194, 819, 1775. The greatest effect was produced by preparation 719 which killed 100% caterpillars on the 6th day.

Table 2

Antibiotic effect on caterpillars of the gypsy moth

Group	Preparations	Length of observation (days)	Number of living caterpillars		Caterpillars perished (%)	Characterization of caterpillars
			At beginning of experiment	At end of experiment		
I	Levomycetin, penicillin, streptomycin, griseofulvin, preparation 070, chloromycetin, erythromycin, chloroamphenicol, viomycin, polylinaxine, bacitracin, usnic acid, preparations 1916, 1706, 1040	20	180	178	1.1	caterpillar development normal, size 4-6 cm
II	Blomycin, terramycin, syntomycin, tetracycline, preparations 1149, R-42, 77, 592, WKS	20	135	135	0	All caterpillars alive but with poor mobility, sluggish, size 2-3 cm.
III	Phytobacteriomycin, preparation 2739	25	40	40	0	Caterpillars ate oak leaves vigorously, very mobile, size from 4.5 to 6.5 cm.
	Preparation 2703	10	40	26	35	Caterpillars with poor mobility, size 1.5-2 cm. eat leaves slowly
	Actinomycin 76	10	30	16	46	
IV	Preparations 1205, 119, 194, 829, 1775	10	100	27	73	
	Preparation 719	6	80	80	100	
	Controls	25	60	59	0	Size of caterpillars 4-6 cm.

To meet [the plans of] the Plenum of TSK KPSS
[Central Committee of the Communist Party of
the Soviet Union] [an editorial]

Zashchita Rastenii, vol. 4, no. 6, p.1-3.
Nov./Dec. 1959. 421 21

(In Russian)

Everywhere, in every corner of the country, hard working men in agriculture, as well as all the Soviet people, greet the next Plenum of TSK KPSS in a proper manner. Kolkhozes and sovkhoses successfully completed the plan for selling grain to the State, as well as other products of agriculture; the preparation of animal husbandry products was increased considerably.

At the Plenum questions will be raised about further development of agriculture, about a still greater increase of production of agricultural commodities.

In connection with this, such powerful reserve as protection of agricultural crop from pests, diseases and weeds acquires a serious importance.

Computations show that this can give to the country hundreds of millions of poods (pood = 36 pounds) of additional bread and other products.

Preplanting treatment of seeds, for example, dependably protects the grain plantings from smut and many other dangerous pests.

According to data of the Agricultural Institute of Central Regions of the Non-Chernozem Belt (Nemchinovka) use of granosan, for this purpose, produces an increase in the yield of spring wheat of 2-3 c

per ha and of barley 3-4 c. Protection of plantings from the bug [Eurygaster], grain moth, Hessian and frit-flies, and other pests and diseases would give the possibility for obtaining on the whole for the country additional stocks of grains not less than 500-600 million poods annually.

Of still greater importance are the measures for the control of pests and plant diseases in cultivation of technical and vegetable crops, orchards and vineyards. A timely treatment of cotton plantings with mercaptophos in order to protect it from the cobweb mite produced an increase of 3.6 c/ha at the kolkhoz "Imeni Chkalova", Kulbyshevsk raion Tadjik SSR, and at the kolkhoz "Vakhsh", of the same raion, over 4 c/ha. Violation of rules of control of the cotton-boll worm, in 1958, was costing many kolkhozes of the Azerbaijan SSR up to 7-8 and more centners of cotton fiber in losses per each hectare of cotton plantings.

Last year at the kolkhoz "Druzha narodov", Krasnogvardeisk raion, Crimean oblast', the vineyards were treated for the control of mildew on an area of 72 ha and the harvest of grapes obtained was on the average of 99.4 c/ha, while at the neighboring workmen's association "Imeni Lenina", where the protection of vineyards was conducted only partially, over 30% of fruits were infected with mildew, and the average harvest from an area of 91 ha comprised only 28.7 c/ha.

Control of many pests does not always require the use of chemical products. There, where the farm is well cultivated, where fall plowing is conducted properly and in good time, as well as

other agrotechnical measures are carried out, the losses of harvests are prevented, and the danger of damage by pests to plantings is reduced to a great degree.

Overrunning of fields with weeds causes great losses to the farm. According to data of the Novosibirsk Agricultural Institute, shortage of spring wheat and other cereals comprises about one third of the yield, owing to this cause. Of deciding importance here is the cultivation of land, the timely and high quality carrying out of agrotechnical measures, such as the preplanting cleaning of seeds from weeds, plowing and cultivation of fallows, fall plowing, destruction of weed plants on the shoulders of roads, on boundaries, on waste lands. Herbicides find an ever wider use in the control of weeds. Numerous data show that chemical weeding of cereal plantings, at very small [Begin p.2] expenditures of money and labor, as a rule, provides, an increase in yield of not less than 2-3 c/ha.

In 1957, at the kolkhoz "Imeni Lenina", Nevinomyssk raion, Stavropol krai, as a result of eradication of weeds with herbicides on each of the 5136 hectares of plantings of winter wheat, a harvest was obtained on the average of 21.3 c/ha, while on the fields with similar soils and conditions of tillage, but without the use of herbicides, the average yield comprised 17.7 c/ha or by 3.6 c/ha less.

The increased provision of agriculture with chemical substances, as well as machines and equipment for their use, the growth of cadres of leaders and specialists at kolkhozes and sovkhoses, as well as

the connected with it raising of the general level of organization of production, permitted during the latter years considerably to improve in many regions of the country the protection of sowings and plantings from pests and diseases. Summing up the results of their work for the Plenum of TSK KPSS, the agricultural workers can report about many achievements also in the field of control of plant pests and diseases. During the current year, as in the previous years, the work on extermination of locust, including also those that migrated in vast swarms to the territory of Turkmen SSR from the bordering regions of Iran, was conducted successfully on an area over 250 thousand hectares. One can say that this one of the most serious, enemies of agriculture, whose devastating raids, even at the present time, produce enormous losses in the bordering countries of the Middle East, does not represent a great danger for agriculture of our country at the present level of equipment of the service for plant protection in USSR.

The work on chemical treatment of sowings that was carried out in regions of the widest distribution of such dangerous pests of cereals as Eurygaster integriceps and the grain moth, made it possible to prevent great losses of yield from these pests on an area of more than 5 mln ha.

Kolkhozes and sovkhoses of cotton raising regions did not permit, during the current year, any significant damages to cotton plantings by the spider mite (Tetranychus urticae), which, in recent years, carried away 15-20 or more percent of the grown cotton yield. The solving of this problem was helped very much, of late,

by the increased provision of cotton-growers with the new highly-effective systemic preparation - mercaptophos. The agricultural toilers of Azerbaijan SSR provided an effective protection of cotton plantings from the most dangerous enemy of this crop - the cotton-boll worm (Chloridea obsoleta).

Use of new chemical preparations - polychlorpinene, mineral-oil emulsions and DDT pastes, in combination with a good organization of protective work, gave the possibility reliably to guard the plantings of sugar beets from damage by the beet pest (Bothynoderes) and many other insects, which up to the present time caused great losses to plantings of this most valuable crop.

Much has been accomplished for the improvement of protection of other technical crops, vegetables, fruit plantings and vineyards. This has been facilitated to a great degree by the socialist competition for the best protection of the harvest from pests and diseases, which was developed on the initiative of agricultural workers of the Rostov oblast'.

Nevertheless, far from everything was done yet. The problems, which were set by the 21st Congress of KPSS, on the increase of production of agricultural commodities, urgently requires further improvement of the service of plant protection, of carrying out in this field of systematic measures. It is very necessary to establish a certain general State rule for the accomplishment of a minimum of protective and especially of prophylactic works on the extermination of the most dangerous pests and diseases of plants; in the first place of those having the ability for mass reproduc-

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tion and spreading on a large territory. These functions must be performed by the State Service, which must also carry on the State supervision of the completion by all the farms, institutions, and individual citizens of the Soviet Union of the compulsory measures for the control of pests and diseases of plants, as well as weeds. As the discussions of this problem among the practical workers have shown, the most rational would be the organization of oblast' (krai) stations of plant protection; the regional instructors should be under the stations subordination; there also should be (depending on the ecological and other conditions) a necessary number of task forces, non-financed by State, which are equipped with machinery and apparatuses. Such task forces, along with carrying out of work, financed by the State, [Begin p.3] must also provide necessary help, according to agreements, to kolkhozes, sovkhoses, collectives of workers and employees, and the owners of individual sections, in the protection of plants from pests, diseases and weeds.

The success of the job, to a great degree, depends on a further provision of agriculture with reliable and sufficiently effective means of protection. The agricultural toilers have a right to appeal to the chemical and machine-building industry, to the planning and leading organizations, and, first of all, to the Gosplan [State Planning Committee of the Council of Ministers of the USSR] and to leaders of Sovnarkhozes [Councils of the National Economy] with the request in short time to satisfy the needs in

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effective means for chemical control of pests and diseases of plants and of weeds, in highly-productive and technically precise machines and apparatuses for the use of these substances. In the first place, it is necessary to increase production of fungicides, particularly, granosan, of trichlorphenate of copper, TMTD [tetramethylthiuram disulfide], to quicker solve the problem about the output of hexachlorobenzene.

The chemical industry has all the possibilities and must fully satisfy the requirements of agriculture in polychlorpinene for the control of the beet pest [Bothynoderes punctiventris] and the and the Colorado beetle [Leptinotarsa decemlineata], master the preparations of diene synthesis, and in the first place of heptachlor, which is extremely necessary for the preparation of combined insecticides and fungicides, as well as concentrates of emulsions, which produce a high effect in the control of many pests of sugar beets and other technical crops. It is time, finally, to remove the deficiency in chemical substances for the protection of orchards and vegetable crops; for instance, estersulfonate, carbophos and methylmercaptophos, to organize a wide production of copper oxychloride and zineb, which can replace the very difficultly available copper sulfate.

Special attention must be paid to the provision of agriculture with herbicides, which continues to be on an intolerably low level. It is necessary to guarantee production of 2M-4X, along with the preparations of the type of 2,4-D, dichloral urea, and especially

of symazine and atrazine - the most effective for the eradication of weeds in corn plantings.

While trying to solve the problems for provision of agriculture with machines and apparatuses for the control of pests and diseases of plants, it is necessary seriously to think about the reduction of their cost, since the selling prices are yet very high, especially for hand apparatuses.

The need for introduction into production of new effective methods and means for the control of pests and diseases of plants and weeds urgently pushes forward the question about strengthening the technical and methodical help to kolkhozes and sovkhoses, as well as to workers and employees, who have personal plots of land, in the organization of their crops and plantings. The agricultural agencies must take care of advising the farming industry and population about the time for protective work, of wide propaganda on the achievements of science and of the leading experience, about new chemical substances, machinery and apparatuses. Further improvement of provision of agriculture with new, more improved means for control of pests and diseases of plants, and help of the State in the quickest acceptance of these means, undoubtedly, will help a fuller utilization of additional reserves for the fastest increase of production of agricultural commodities in quantities, that will fully satisfy their requirement by the population and by the national economy.

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Kulibaba, IU. F.

Zamenitel' bordoskoi zhidkosti

[Substitute for the Bordeaux mixture]

Zashchita Rastenii, vol. 4, no. 6, p.41-42.
Nov./Dec. 1959. 421 21

(In Russian)

The new preparation of the basic copper sulfate, developed by NIUIF [Scientific Research Institute of Fertilizers and Insecto-fungicides], was tested by us, in 1958, in 1% concentration for the control of apple scab.

The poison chemical is a finely ground greenish color powder, that can be wetted, containing 50-55% of basic copper sulfate (26-32% Cu in conversion to metallic copper), 5% of sulfite liquor, 1% of dextrin and not more than 2% moisture. Its advantage over the Bordeaux mixture is in the fact that it is sold ready to be used and is utilized for spraying plants in the form of water suspensions without the addition of lime. The solution for the working liquid is prepared by a simple mixing of the preparation with water. The toxic element is copper in the form of the basic compound $3 \text{ Cu}(\text{OH})_2 \cdot \text{CuSO}_4$. The basic copper sulfate does not produce any burns on the apple tree even in a 2% concentration.

The experimental orchard (sovkhoz "Mikhailovskii pereval" Gelendzhik raion, Krasnodar krai) of an area of 2 ha is situated

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in the valley of the river Doguab. The trees are 30 years old, variety "Renet Simirenko", a thick top of trees, well developed; agrotechnical measures [Begin p.42] are conducted every year. Ten trees were taken under the experiment. Half of them were treated with the new preparation, the other half with the 1% Bordeaux mixture (standard). Altogether five sprayings were conducted with the aid of ONK [name of a sprayer]: May 31, June 23, July 3, 12 and 25. Forty liters of 1% suspension of copper sulfate were used up for each tree.

One should mention, that preliminarily, during the period of the green cone (April 10) the apple trees were treated with a 4% Bordeaux mixture. To the moment of the first experimental treatment the experimental trees had a mark of 0.1 for scab infection. The effectiveness of the tested preparation was determined by taking into account the scabs on leaves and fruits in the harvest, according to the method of VIZR [All-Union Institute of Plant Protection], by the Chief Scientific Co-worker of the Gelendzhik base of the Station, O. M. Sokolova. All trees were infected with the scab. The percent of development of the disease was as follows (see the table).

Date of accounting	Experiment	Standard
June 2	3.3	3.3
June 26	15.3	33.3
July 8	27.3	33.3
July 23	27.3	53.3
On the average	18.3	30.8

The amount of infected fruits and the degree of their infection in the experiment were smaller (in marks): 0 - 75.5%, I - 17.6%, II - 4.7%, III - 1.9%, IV - 0.3%, while in the variant with the Bordeaux mixture: 0 - 41.8%; I - 39.9%, II - 6.6%, III - 6.3% and IV - 5.4%. The percent of development of the disease on fruits comprised, correspondingly, 8.4 and 23.3%. Thus was established the effectiveness of the basic copper sulfate for the control of apple scab. The washing off of this preparation is somewhat lower than of the Bordeaux mixture. All this permits recommending it for a wide production test for the control of scab in pit fruit orchards as a possible substitute of the Bordeaux mixture

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Lipsits, D. V., Khizhniak, P. A., and Sazonik, Kh. V.

Deistvie gamma-izlucheniia na rak kartofeliia

[Effect of gamma-rays on potato canker]

Zashchita Rastenii, vol. 4, no. 6, p.47-48.
Nov./Dec. 1959. 421 21

(In Russian)

At the present time a great number of investigations is already known about different ways for utilizing ionizing radiation in agricultural practice: for retardation of potato sprouting, as mutagenic factors, for the stimulation of growth and development of the plant, for sterilization of fruits, vegetables, meat products and others.

Some of the scientists raise a question about the use of radiations for disinfection of the soil from pathogenic microorganisms. The first such suggestion was made by A. A. Geiron* in respect to the pathogen of potato canker.

During the course of two years we studied this problem with the aid of the gamma-emitter Co^{60} , in the form of 12 cobalt-nickel wires of total activity (on April 27, 1956) of 132 milli-curie. Having first insulated them by thin rubber bags, they were placed in clay containers, filled with soil (mixture of garden soil

g. Chernovtsy. Vsesoiuznala stantsiia po Raku Kartofeliia VI2R [City of Chernovtsy. All-Union Station on Potato Canker of the All-Union Institute of Plant Protection].

* Bull. izobretenii [Bulletin of Inventions], 1957, no. 3, p.59.

with sand in a ratio 1:2), that was inoculated with the canker pathogen (100 g sporangial powder per 2 kg of soil). The containers were placed in a special small house behind massive masonry. The control containers, which were not subjected to the radiation, were fitted out in the same way. The moisture content in the containers was maintained at the level of 40-50% of full capillary water capacity, with the exception of the winter time, when watering was stopped. After the end of the experiment the wires were removed and a biological testing of the state of the fungus was carried out. For this purpose the irradiated soil was mixed with 8 times as much of similar soil; containers were filled with it and potato tubers, of a variety susceptible to canker, were planted there (the first biotest was conducted in standard boxes).

At the first irradiation two wires were placed into one container, and further on all the 12, in order to increase the dose of irradiation of the fungus sporangia as much as possible.

When calculating the power of the dose*, we utilized the following basic formula

$$D = \frac{K M t}{R^2}$$

where D is the dose of irradiation in roentgens at the distance R from the source of irradiation (in cm), t - time in hours, M - activity of the source of irradiation (in millicurie), K - the

* The authors express their gratitude for the valuable advice to A. I. Zaitsov (Coordination Section of Research on the Application of Atomic Energy in Agriculture, VASKHNIL [All-Union Academy of Agricultural Sciences imeni V. I. Lenin] and to S. P. Tselishchev (Timiriazev Agricultural Academy)

constant, showing what power of the dose of gamma-rays is being created by the point source of radioactive isotope by the activity of 1 millicurie at the distance of 1 cm in 1 hour's time (for $\text{Co}^{60} = 13.5$). Nevertheless, we had to introduce into this basic formula several correcting coefficients, which allow for the reduction of the rays in the soil and by moisture, present in it, as well as a certain decomposition of Co^{60} and scattering of the rays. The layer of sand, 8, 6 cm thick, reduces by two the gamma-rays passing through it. Consequently, one can consider, [Begin p.48] with a certain approximation, that in our case the layer of soil, 7 cm thick, reduced the rays by 1.62 times. Correction for moisture had to be approximate, since in our case it was not strictly controlled, and during the cold time of the year, as was said previously, the watering was stopped altogether. Considering that 1 cm of water was present in the 7 cm layer of soil, and that the layer of half absorption of gamma-rays Co^{60} for water equalled 15.7 cm, we obtained a correction value of 1.127. By virtue of the matter that not only direct gamma-ray quanta ["gamma-kvanty"], but also the reflected ones fell on the fungus sporangia, the total intensity of the radiation, consequently, must have been increased approximately by 20%. Calculations have shown that after the first irradiation the sporangia of the canker pathogen in direct proximity of the source of radiation, received (in rounded off figures) a dose of 1756 thousand roentgens and at the periphery of the container - 20 thousand; after the second irradiation, correspondingly, 5555 thousand and 62 thousand; after the third - 17,975

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thousand and 156 thousand roentgens.

Data about results of biological testing of the condition of the canker pathogen are cited in the table.

Time of irradiation	Dose at the periphery of the tuber (thousand roentgens)	Experiment		Control	
		Plants in all	Canker infected	Plants in all	Canker infected
July 13, 1956-February 16, 1957	20	75	2	50	11
February 16, 1957-June 10, 1957	62	5	1	55	4
June 10, 1957-April 30, 1958	156	6	0	55	3
		6*	0	6	5

* The biotest was conducted a second time.

The obtained results indicate, that under the effect of gamma-rays in a dose above 150 thousand roentgens the canker pathogen already does not infect the tubers of the susceptible potato variety. Apparently, the cause of this is in the loss of the ability to germinate by the sporangia. We failed to see, in microscopic examinations, any regular differences between the irradiated sporangia and the nonirradiated.

It seems to us that the obtained data can serve as initial material in the construction of the machine that is intended for the liquidation of isolated foci of potato canker by the effect of gamma-rays. In it the gamma-emitter must not be made suspended, as A. A. Geiro has suggested, but in the form of a cultivator ["freza"] or rods that are stuck into the soil at a depth of 25 cm. The

weight of the protective arrangement for the machine in question will not exceed 4-5 t. One should mention, in conclusion, that the use of gamma-rays for sterilization of the soil does not create in it any induced or residual radioactivity. We intend, later on, to define more accurately the effectiveness of gamma-rays at different temperatures and moisture content of the soil.

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Poliakov, I. Ia.

Nekotorye itogi prebyvaniia Amerikanskoi
Entomologicheskoi Delegatsii v SSSR

[Certain results of the stay of the American
Entomological Delegation in USSR]

Zashchita Rastenii, vol. 4, no. 6, p.56-57.
Nov./Dec. 1959. 421 21

(In Russian)

The American delegation of specialists on the protection of plants visited USSR from July 10 to August 9. Its members were: Paul W. Oman (head of the delegation) - President of the Entomological Society of the USA (a systematic, specialist in the Homoptera group), Head of the Section of Insect Identification and Parasite Introduction, Agricultural Research Service of the Department of Agriculture of the USA; Lev F. Curl - Assistant Chief of the Section of Control of Pests, of the Agricultural Research Service of the Department of Agriculture of USA; Herbert L. Heller, Assistant Chief of Agricultural Research Service (specialist in the use of poison chemicals), Theodore B. Davich, chief of a plant protection station of a Texas college, specialist on cotton; Professor Halbert M. Harris - Chief Entomologist of the Experimental Station and of the State of Iowa (systematic specialist on Heteroptera group and on methods of corn protection), Carl B. Huffaker, Associate Entomologist of the Section of Biological Control at the California University (specialist on biological methods of protection from weeds and harmful insects), John B.

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Osmun, Head of the Entomology Department at Purdue University, State of Indiana (specialist on control of bloodsucking insects, domestic and warehouse pests).

The American delegation visited many raions of Georgia, Ukraine, Uzbekistan, Kazakhstan (virgin lands), besides Moscow and Leningrad. In all the American guests, accompanied by the author of these lines, got the better of over 25 thousand kilometers of airplane flight and about 3 thousand km of automobile driving during the course of one month; they visited 22 scientific-research institutes and experimental stations, 2 academies of agricultural sciences of the republics, 1 training ["uchebnyi"] institute and 9 kolkhozes, sovkhoses and training farms. The trip through USSR permitted our colleagues to receive a sufficiently full idea about the problems of protection of plants in different zones of fruit-growing, cotton growing, sugar-beet raising, in growing of grain crops in old and new regions, as well as ways and methods of their solving and of practical work in kolkhozes, sovkhoses and experimental farms. During the process of interchange with the delegation, the state and trend of plant protection in USA became clear to a certain degree. In Moscow, during a meeting with our entomologists, the American specialists briefly told us about the condition of some sections of work in USA. They shared their impressions of the trip in USSR at the reception of the Assistant-Secretary of Agriculture of USSR, G. A. Borkov.

In general, the delegation appraised highly the work that is being conducted in USSR on the protection of plants; they, in

particular, mentioned that in our country pre-planting treatment with insectofungicides is conducted to a much greater extent, aviospraying and aerosols are used on a far wider scale, and the service of accounting and prognosis is well organized.

Special interest was evoked by the research, conducted in our country, on methods for utilizing predatory parasites for the control of pests. The matter is, that during the last 15 years USA intensely developed the chemical method and lagged behind USSR in the biological method. The guests appraised, as a very positive phenomenon, that we pay much attention to the combining of agrotechnical, ecological and chemical measures of action on pests. The delegation acknowledged the high level of scientific work on plant protection in USSR and showed great interest in the ways used for its coordination on a state-wide scale and implantation of results obtained into production. [Begin p.57] At the same time the Americans think that, on the whole, the problems of plant protection in USSR are less complicated than in USA, where the specific makeup of pests is more varied and where, owing to wide and insufficiently careful application of poisonous preparations, many species have already developed a resistance to poisons.

In the opinion of the guests, work of identification of the species makeup of pests is conducted on a much wider scale in USA (yearly the Central Bureau alone makes 112 thousand identifications), low-volume ["nizkoob'emnoe"] spraying is being utilized and pre-

parations of diene synthesis - aldrin, dieldrin, endrin and others, as well as the granulated (for control of the corn borer) are utilized on a large scale [in the USA].

In the USA the danger of mass reproduction of Mediterranean fruit fly, which caused great harm to horticulture, has been basically liquidated. Fifty-eight thousand glass and plastic fly traps are used for its detection. Dermestidae, which damaged grain in store houses, have been checked; the harmfulness of the Colorado potato beetle is being fully averted; this has been attained on the basis of systematic detection of foci of the pest and the use of thorough exterminating means at the Government's expense.

The cutworm is controlled by aldrin. Tent fumigation is very well and effectively utilized, whereupon even in disinsectization of large grain-storages and elevators impenetrable fabrics are used.

It is also interesting to mention the application of a biological method of control of weeds on the basis of import of insects, which are able to destroy them. So far there is only one positive example, but it is very convincing. The weed Hypericum perphoratum spread over 4 mln ha of pastures, depreciating their value, but was practically entirely destroyed during the course of 5 years as a result of introduction of two species of insects from the genus Chrisolina.

It is necessary to point out that the prevalent opinion, that the biomethod of control of pests is widely used in practice in USA, was not shared by the members of the American delegation.

During the last 15 years, as it was mentioned previously, the chemical method has dominated absolutely. One must have in view that in USA under the biological method are implied, first of all, development of agrotechnical and ecological measures, development of resistant varieties of agricultural crops, and only after that - the utilization of entomophages and disease pathogens. Nevertheless, a tendency is appearing for enriching the fauna of entomophages by means of their acclimatization. A suggestion was made about the exchange of entomophages between our countries.

The report of the delegation about organization of scientific work on plant protection in USA was of great interest. In the Department of Agriculture exists the Agricultural Research Service with a Branch for the Control of Pests, which ensures the development and introduction into practice of methods of plant protection. Control of 20 of the most aggressive pests is conducted at the expense of the Government. The Service regulates the sale of both poison chemicals, as well as the machinery. As Mr. Haller reported, approximately 100 mln dollars are being spent for the scientific work of plant protection annually. Extensive research is conducted at the Stations and in Laboratories of the States. At the same time, in order to obtain mass uniform material, artificial nutrient media are widely used for rearing experimental insects for this purpose. According to the words of Mr. Davich, the nutrient medium for the cotton-boll weevil was synthesized from 40 chemical substances. In a week's time 5 workers can rear 15 thousand individuals of this genus.

Extensive work on the evaluation of the preparations and determination of effective forms for their use are conducted also in laboratories and stations of chemical firms. In the opinion of Mr. Haller, the scientific work for evaluation of each new preparation costs 1-2 million dollars.

Special attention should be accorded the [US] experience with the publicizing of knowledge about harmful insects and methods for their control among the population, which is strengthened by an output for sale of various portable means [of control]. Thus, for fine-drop spraying with different preparations, the industry produced siphon jars [aerosol bombs] of various holding capacities in great numbers. It is sufficient to unscrew the cap of such a can and press a button in order to start spraying. A clearly printed label is pasted on the can, informing against which pests the contents of the aerosol bomb can be used.

In conclusion I would like to point out the mutual advantage of a direct contact between specialists on plant protection of USSR and USA. The trip of American entomologists to USSR permitted their better understanding of the fundamental problems of plant protection in our country, and [permitted] our specialists to learn a lot of new things about the practice for the control of pests and diseases in USA. This gives a basis for hope that the contacts of specialists on the protection of plants in USA and USSR will continue to grow.

To strengthen the connection of biology
with practice. [Editorial]

Akademii Nauk, Vestnik, vol. 29, no. 3,
p.3-7. March, 1959. 511 Ak14V

(In Russian)

The Soviet people, under the leadership of the Communist Party, scored a great historical victory in the job of building a socialist society in our country.

New grand problems are set before the Soviet People by the 21st Congress of the KPSS [Communist Party of the Soviet Union]. They inspire the Soviet people, including the scientists, to further creative successes in the building of the first Communist society in the world.

By further developing the heavy industry, in every way possible, as a basis of the entire national economy, it is necessary to provide, during the shortest time possible, a sharp increase in agricultural production and, thus, to create for the Soviet people an abundance of foodstuffs, and the necessary raw materials for industry.

"Creation of a material-technical basis for Communism", N. S. Krushchev mentioned in his report to the 21st Congress of KPS! "requires the flourishing of science, of active participation of scientists in the solving of problems, connected with a further many-sided development of production forces of our country. The Seven-

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Year-Plan opens up before our scientists and scientific institutions the widest field of activity. There is a place to apply one's energy and knowledge!"

The development of all fields of knowledge, including the biological science - the basis of agricultural and medical sciences, is of great importance in the carrying out of problems of the 7-Year-Plan. "The importance of the complex of biological sciences will be growing, especially, in proportion to the application of achievements of physics and chemistry in biology. Whereupon a great role will be played by such branches of the science as biochemistry, agrochemistry, biophysics, microbiology, virology, selection and genetics". (From "The Control figures of development of national economy of USSR for the years 1959-1965", which were approved by the 21st Congress of the KPSS).

A bond between theory and practice, of science and production acquires exclusive importance during the new stage of the unfolded construction of the Communist society. The December Plenum of the TsK of KPSS [Central Committee of the Communist Party], where results of victories, scored by our country during the last 5 years in the business of the sharp rise of agricultural production, were summed up and new problems raised for a further rise in productivity of plant growing, animal industry and an increase in the general culture of agriculture, paid special attention to the strengthening of the bond between science and production.

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This refers to a large degree to biology; its development is the necessary premise for a mighty raising of agriculture, as well as of forestry, fish industry, sanitation, of industry, reprocessing raw materials of plant and animal origin. [Begin p.4]

The expanded Session of the Presidium of the Academy of Science of USSR and the Department of Biological Sciences together with the active members of the Department took place on January 20; the Session discussed the work and problems of the Department of Biological Sciences in the light of resolutions of the December Plenum of the Central Committee of KPSS.

On the basis of the report of the Academician-Secretary of the Department of Biological Sciences, V. A. Engel'gardt, of the report of the Committee of the Presidium, which examined the work of the Department, and of the discussions, which developed after this, a resolution was adapted; in it was given the evaluation of the activity of the Department and its chief problems were pointed out.

The resolution states that the Party and the Soviet Government render generous help and support to science. In our country biological science has unlimited possibilities for the application of results of scientific-research activity to practice. The bond between science and production is not one-sided, since while working for practice, science, in its turn, gets from practice new important facts and ideas, which are subject to scientific development.

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The Department of Biological Sciences of the Academy of Science of USSR includes a large circle of scientific establishments, in which problems are developed that are important in theoretical respect: chemical structure and biological functions of protein substances, regulation of heredity and vitality of plant and animal organisms, physiology of the highest nervous activity, interaction between the cerebral cortex and the internal organs, regularities of effect of nuclear radiation on biological objects, direction of metabolism of microorganisms, biological principles of parasitism, photosynthesis, nutrition and development of plants, efficient use and increase of productivity of soils of USSR, the fauna and flora of USSR, scientific principles of forestry, and others.

During the last 2-3 years, the Department accomplished the work on compilation of prospective plans (notes) on 16 leading problems of biology for the next period. To this work were attracted scientists and representatives of Ministries, of Gosplan [State Planning Committee of the Council of Ministers of the USSR] of USSR and other establishments.

The Department strove for the development of its research in those directions, which, along with the solving of general problems of science, would also be widely useful in practice. Thus, areas of virgin and waste lands in the country, having prospects for new reclamations, were detected; a State Soil Map of USSR for basic agricultural regions was compiled (by the Soil Institute, imeni

V. V. Dokuchaev); high-yielding wheat-couch grass hybrids (on an area of about 200 thousand ha) were developed and are being introduced into agriculture; they yield up to 60 c of grain per 1 ha (The Main Botanical Garden). By means of matching the pairs, hybridization and selection, under specific conditions of growing, a herd of cows was created, which was distinguished by a high content of fat in milk (5.1% against 3.5%) and by the heavy weight of animals (on the farm of the Institute of Genetics). Preparation "M-1" has been introduced; it inhibits the sprouting of tubers of food potatoes during storage; this raises the yield of commercial potatoes by 10-14% (Institute of Plant Physiology imeni K. A. Timiriazov). Effective methods for drying and storage of newly harvested grain, as well as of fruits and vegetables were developed (Institute of Biochemistry imeni A. N. Bakh).

A doctrine about natural focalisation of diseases of men, animals and plants was formed (Zoological Institute). A series of helminthiasises in men and animals was studied and measures developed for the control of these diseases (scientific-research institutions under the leadership of Academician K. I. Skriabin). [Begin p.5]

All this shows that the Institutes of the Department of Biological Sciences are able to raise and solve scientific problems of great practical importance.

Nevertheless, the scientific-research work of the Department, as it was pointed out in the resolution, was not sufficiently directed

for solving the basic problems, which face agriculture, forestry, sanitation, industry, which reprocesses raw materials of biological origin, and fish industry. The practical results and suggestions, offered by the Department's institutions, by the December Plenum of TsK KPSS.

The Presidium of the Academy of Science of USSR and the Bureau of the Department did not direct the work of the institutes sufficiently persistently in the rendering of constant and systematic help to the practice. For this purpose it was necessary that the Department systematically cooperate in its work with other departments of the Academy, with Ministries of Agriculture, Sanitation and the Academy of Medical Sciences of USSR, as well as more often conduct experiments and tests of its suggestions directly at sovkhoses, kolkhoses, medical establishments and factories.

The Department's Bureau did not pay sufficient attention to practical uses of biological research; it controlled very loosely the course of introduction of the accomplished scientific-research works. Undoubtedly, the guarantee of success of introduction of such works lies in a close contact of the scientific-research institutions with industrial, agricultural and medical establishments. It should find its proper development. Yet, extensive measures cannot be carried out by individual workers and institutes without constant help from the Department and the Presidium of the Academy.

The resolution draws attention to the serious mistakes in comprehension and conducting of criticism of scientific work permitted

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by the Department's Bureau.

Owing to the measures adapted by the Party, all the necessary conditions were set up for the development of scientific research and all the scientists were given the opportunity for fruitful work. Nevertheless, certain biologists, instead of centering all their energy in a further creative development of Soviet biology and utilizing its attainments in the national economy, made the criticism of certain principles of the Michurin doctrine and discrediting of the achievements of the Academician T. D. Lysenko, and of his followers, almost their chief aim. At the same time, these critics gave few suggestions for basic improvement in different fields of agricultural production on the basis of their own scientific-research works.

The "Botanical Journal" made it a point during the last several years to criticize certain principles of Michurin's doctrine and, in particular, the achievements of Academician T. D. Lysenko and of his followers. Such an attitude of its editorial staff was wrong and it hampered the development of Soviet biology. The Bureau of the Department, regardless of repeated instructions from the Presidium of the Academy, did not take any measures, and the Presidium did not correct the editorial staff of the "Botanical Journal" in good time.

It is necessary to stress that premises, ways and approaches for the establishment of scientific truth can be different and it

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is not always clear beforehand which of these ways and approaches will faster and better lead to the solving of the raised scientific and practical problem.

Each truly scientific trend, issuing from principles [Begin p.6] of dialectical materialism, can develop only on the basis of exactly established facts, which were obtained both from the scientific experiment and from practice. Therefore, each controversy, arising among scientists, who examine one and the same problem, but who follow different routes in its development, must be solved not by wordy disputes, but on the basis of conducting joint experiments and mutual experimental and practical verifications.

Scientific criticism must be permeated with the spirit of goodwill and mutual assistance, it must place before itself the problem of strengthening the materialistic positions in science.

The history of science and, particularly, history of biology knows instances when scientific disputes, solved by methods of experimental verification, helped a rapid disclosure of the scientific truth and ended up in extensive scientific discoveries. Practice must be the final criterion of the truth of the theory.

Presidium and the Department of Biological Sciences pointed out, during their joint Session together with the active members of the Department, that the efforts of biologists of the Department must be directed to the formulation and development of important theoretical problems of biology, which would help in the solving of national

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economic problems in the field of agriculture, sanitation, food and light industry, as well as fish industry.

At the same time it was particularly mentioned that the progressive development of modern biology is impossible without the wide, bold and creative use in biology of achievements of physics and chemistry. The penetration of physics and chemistry into biology will lead to the enrichment not only of biology, but also of physics and chemistry.

The Department's Bureau must, together with the leaders of scientific establishments of the Department and with the attraction of the interested Ministries and Services, define more accurately and supplement the basic directions of the 7-Year-Plan of the Department in the light of resolutions of the December Plenum of TsK KPSS and problems, which were raised by the 21st Congress of the KPSS; develop, in the shortest time possible, specific measures on the organization of wide introduction into practice of the most important results of research, which were carried out in the scientific establishments of the Department, set a course for the establishment of extensive cooperation with institutions of other departments of the Academy of Science of USSR, VASKHNIL [All-Union Academy of Agricultural Sciences imeni V. I. Lenin], Academy of Medical Sciences of USSR, and branch institutes of sanitation, as well as with industrial establishments.

In view of a great theoretical and national economic importance of the question about the complex development of biology, chemistry and physics, the Bureau of the Departments of Biological, Chemical and Physico-Mathematic^a Sciences must define the course of the plan of joint research for the three departments and work out the suggestions about the organization of a complex of research by biologists together with physicists and chemists.

The participants of the Session acknowledged as correct the criticism, set out by the newspaper "Pravda", about the wrong position, which was taken by the editorial staff of the "Botanical Journal".

The editorial staffs of biological journals have suggested helping by all means in the development of the materialistic natural science, and fight against idealistic conceptions.

The Bureau of the Department of Biological Sciences must carry out a systematic guidance of the journals of the Department and give help to editorial staffs in the organization of discussions on essential and disputed problems of biology, based on results of experimental works, guaranteeing a correct, businesslike creative discussion of these problems. [Begin p.7]

A series of measures on the rendering of immediate help to the institutes of the Department were provided for the carrying out of problems, that face the Department of Biological Sciences. The construction organizations of the Academy must guarantee the

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completion of the building for the Institute of Biochemistry "Imeni A. N. Bakh" in 1959, of two school buildings for the institutes of the Department in 1960, and give an estimate about reconstruction and expansion of the building of the Zoological Institute in Leningrad; a question was raised about a building for the Institute of Genetics.

It is necessary to realize the resolution of the Presidium, of the year 1957, about the formation of the Institute of Radiation and Physico-Chemical Biology and to provide physicists and chemists to take part in its work.

The Presidium, Department of Biological Sciences and the active members of the Department expressed their strong conviction that the creative efforts of Soviet biologists will be directed to the development of important scientific problems, to the extended use of physics and chemistry, having in view the omnifarious development of the bond between science and practice; this will provide the greatest help of biologists to the work of the expanded construction of the Communistic society.

Milovanov, V. K.

Dostizheniia i zadachi iskusstvennogo osemeneniia
sel'skokhoziaistvennykh zhivotnykh

[Achievements and aims of artificial insemination
of farm animals]

Vestnik Sel'skokhoziaistvennoi Nauki, vol. 4, no. 9,
p.92-99. September, 1959. 20 V633

(In Russian)

The artificial insemination of agricultural animals has been widely implanted into the practice of Soviet animal husbandry. In USSR over 35 mln animals were artificially inseminated in 1958; not less than 50 mln, that is about half of all the female livestock of sheep and cows, is expected to be inseminated in 1959. Artificial insemination is applied far wider in USSR than in other countries (figure 1). For instance, in USA, where the livestock of animals is very great, in 1956, only 6 mln head were artificially inseminated, that is six times less than in USSR. In the comparative range of female livestock of cows and sheep in artificial insemination, USSR occupies a third place in the world. The superiority is held by Denmark (92%) and Czechoslovakia (72%). Nevertheless natural conditions of these small countries cannot be compared with extremely varied and, often, difficult conditions of the huge territory of the Soviet Union. Already now there exist, in USSR, raions with 100% artificial insemination of cows (for instance,

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Prisheksninsk raion, Vologda oblast', Borodiansk raion, Kiev oblast', Lebedinskii raion, Sumy oblast', Aramil'sk raion, Sverdlovsk oblast', and others); and in many oblast's of the Ukrainian SSR, in 1958, 80% of the entire female livestock of cows (Poltava, Kiev and Dnepropetrovsk oblast's) were artificially inseminated. It is proposed, by the year 1965, to inseminate artificially 85% of the female livestock of cows and 87% of female livestock of sheep; that is, virtually, the entire basic female livestock.

In USSR artificial insemination is especially widely used in sheep raising. In 1958 29 mln females (57% of the female livestock) were inseminated in this manner. Sheep breeders are trying, in 1959, to inseminate not less than 40 mln females (about 3/4 of the female livestock of sheep).

Title of figure 1. Artificial insemination of cows and sheep in 1958-1959 (the countries, where less than 1 mln females were artificially inseminated annually, are not cited): A - range of female livestock of cows and sheep (in %), B - amount of females inseminated during the year (mln head).

Words in figure 1. Above the figure: A; B.

First line: USSR

Second line: USA

Third line: Bulgaria

Fourth line: England (incl. Scotland and Ireland)

Fifth line: France

Sixth line: Czechoslovakia

Seventh line: Rumania

Eighth line: Denmark

Ninth line: Federal Republic of Germany

Tenth line: German Democratic Republic

Eleventh line: Netherlands

Soviet methods [Begin p.93] of artificial insemination of sheep are successfully used by sheep breeders of Bulgaria, Rumania, China,

Mongolia, Albania, and others, inseminating, yearly, millions of female sheep with excellent results. At the same time not one capitalistic country, until now, could utilize artificial insemination of sheep so widely, although during the course of over 20 years repeated attempts were made in this respect.

During the last three years, artificial insemination of large cattle (milch) has spread widely in USSR. In 1955, 1 mln cows were artificially inseminated; in 1957 - 2.5 mln; in 1958 - 5 mln 443 thousand, but in 1959 it is planned to inseminate artificially 10.6 mln cows; this will comprise $\frac{1}{4}$ part of the female livestock in the country; this is more than in England and USA taken together. Thus, if this plan will be carried out, then, in 1959, the Soviet Union will overtake USA not only in the percentage of the range, but also in the total number of artificially inseminated cows per year (figure 2).

Title of figure 2. Dynamics of growth of artificial insemination of cows in USSR and USA.

Words in figure 2. Right, outside the figure: Cows inseminated (mln head). Inside the figure: at the top - USSR; at the bottom - USA. Below the figure - Years: 1930, 1940, 1950, and 1960.

In USSR the rates of increase of artificially inseminated cows are extremely high. In USA, in past years, the artificial insemination of cows grows, on the average, by 5-6% per year, and in the Soviet Union by 100% per year (that is, it is doubled). Such a rapid growth became possible because in USSR artificial insemination in

kolkhozes and sovkhoses is being organized by the State Stations on Breeding Work [Begin p.94] and Artificial Insemination and by State and Interkolkhoz Stations of Artificial Insemination. This form of work was used yet during the prewar years at Nizhne-Tagil'sk, Prishchinsk, Volokolamsk, Molochansk and other State Breeding Farms. During the postwar years arose the problem on reorganization of artificial insemination; numerous projects for organization of special stations for artificial insemination were developed locally.

Reorganization of work on artificial insemination told both in a sharp increase of the rate of insemination of cows as well as in the rise of the yield of young animals. For instance, at Novopokrovsk State Station (Kirghiz SSR, the oldest in the Union, during the 11 years 66,270 cows were artificially inseminated; fertility [translator's note: the word sterilnost' (sterility), in the original is undoubtedly an error] comprised during the first years 94-95% (during the last 7 years 96-97%). The successes of Kuibyshev Oblast' Station on Artificial Insemination, the largest in USSR, are well known*. In some of the raions of this oblast were obtained 100-105 calves per 100 cows, and on the whole for the oblast' the barrenness was reduced from 23 to 3-4%.

In Belorussia artificial insemination is as yet not used sufficiently (only 8.4% of cows are artificially inseminated) and the

* About the work of this station see article of P. P. Agapov in the newspaper "Sel'skoe khoziaistvo" for March 17, 1959.

barrenness up to the present time is extremely high - up to 33%. With the organization of State Stations for Artificial Insemination the situation has changed sharply. In the region of the activity of Vitebsk Interrailon Station from among 14,128 artificially inseminated cows, 1112 proved to be barren (less than 8%), that is 4 times less than for Belorussia as a whole. In Orshansk raion artificial insemination reduced barrenness of cows to 3.5%, while in kolkhozes of Chashniksk raion, where artificial insemination was not used (only 14 cows were inseminated) the barrenness reached 22.7%. At the same time at the kolkhoz "Imeni Lenina", Vitebsk raion, in 1958, 97 calves were obtained per 100 cows after artificial insemination^{**}. At the Mogilev Oblast Agricultural Experimental Station, organized two years ago, the barrenness of 3,800 cows comprised not more than 3-5% (according to the report of the zootechnician of the Station, E. G. Zheleznina). One could cite many similar instances^{***}. They show that introduction of artificial insemination helps in a rapid and mass reduction of barrenness. Along with this there still are many stations of artificial insemination where, on account of badly organized work, the fecundity of animals is low, infectious diseases are widely spread, and so on. Work at the lagging stations must be lifted to the level of the leading ones. The leading stations, in their turn, have inexhaustible possibilities for the improvement of their work.

^{**} According to a report of the Scientific Co-Worker of Oblast Agricultural Station, L. N. Gorokhov.

^{***} See Collection "Experience in the organization of artificial insemination of agricultural animals", M., 1959.

Artificial insemination permits using better bred producers. In the Baltic region all the producers at the stations of artificial insemination are the elite ones; in Kirghiz SSR 80% of elite bulls are used; in RSFSR - 71%, in Ukrainian SSR - 70%; the situation is much worse in Transcaucasia; in Azerbaijan - 62%, in Georgia - 58%, in Armenia - 43% of producers are elite. Introduction of artificial insemination improved the use of pedigreed producers; up to 800-1,000 cows received the semen of one pedigreed bull. In individual cases were obtained up to 5,000 calves and over 18 thousand (18,414) lambs from one producer; [Begin p.95] this virtually, permits refusing the utilization of bad producers. The number of descendants of elite producers, obtained at kolkhozes and sovkhoses, rose sharply. For instance, in Kuibyshev oblast', in 1956, (before the organization of the station) only 1 thousand elite calves were obtained, while in 1958 - 33 thousand.

The attained successes show that we have found new, progressive forms of organization of artificial insemination and this method became the most important means for mass breeding improvement of animal husbandry at the kolkhozes and sovkhoses.

During the next seven years, artificial insemination must be expanded still more. Animal husbandry workers are faced with a real problem of artificially inseminating the entire female livestock of large cattle, sheep, goats, swine and horses at kolkhozes and sovkhoses, using only the elite and the record-breaking producers; of obtaining during the period of the Seven-Year-Plan two

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or three generations of animals descending directly from the best pedigreed producers of the country; that is, entirely to stop using poor-quality males. This will help radically to renew the herds of kolkhozes and sovkhoses, replacing all inefficient animals with $3/4$ or $7/8$ thoroughbreds. Such a replacement is necessary in order to raise the productivity of animals, which later on will depend not only on the abundance of feeds but also, to a large degree, on the hereditary characteristics of animals.

It is necessary to create, at the present time, specialized beef cattle for a sharp rise in the production of beef. In view of a deficiency of pedigreed producers of specialized beef breeds of cattle, it is necessary to utilize the experience of production of the Kazakh Whitehead ["belogolovoi"] breed, numbering at the present time 300 thousand head. It was only the use of artificial insemination that helped to produce such a block of animals in the presence of several dozens of pedigreed bulls of the beef breed. A similar work, but on a much larger scale, was conducted by Soviet animal husbandmen in creating the multimillion herds of fine-wooled sheep, utilizing a limited number of high-quality fine-wooled rams.

We think that it is necessary in the basic regions of the beef cattle industry to form large mechanized stations of artificial insemination (which will be supplied with refrigerating plants, auto and auto-transport and radio communication); there should be collected 100 or more pedigreed bulls of specialized

beef breeds. Each such station can serve, under conditions of South-East and of Kazakhstan, up to a million cows (by loading the deficit [numbers of] producers with from 5 to 10 thousand and more females per year). In the regions of beef animal husbandry these stations can utilize the bulls all the year round and prepare stocks of frozen semen for the pairing season. This will permit, during the course of 7 years, obtaining a multi-million block of 3/4 thoroughbred cattle of beef breeds.

Besides that, the bulls of beef breeds must be also used in the regions of milk production. The semen of such bulls must be used to inseminate inefficient cows, whose calves are not suitable as replacements of the milk herd. The obtained calves can be grown for fattening locally or transported to regions of virgin lands for the formation of blocks of beef cattle.

In conformity with problems of the 7-year national economy plan, the workers in animal industry require serious help from scientific establishments in order to develop the breeding work, as well as artificial insemination. It is necessary to develop a more improved and practicable technique of artificial insemination for mass production and use; that is, it is necessary to develop construction and technology for the preparation of devices [Begin p.96] for artificial insemination from synthetic polymeric materials; for instance, devices, prepared to be used only once, will facilitate the work and remove the possibility

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of spreading infectious diseases (single-use thermoses for the transport of semen, tubes for artificial vagina, injectors, catheters for insemination, and others); it is necessary to improve simple and practicable methods for short-term storage of semen without cooling and for prolonged storage of semen in a frozen state with the use of liquid nitrogen (at -193°), as well as in a dried state; to improve methods of insemination of females for a further increase of their fecundity.

In 1959, the Central Station of Artificial Insemination of VIZH [All-Union Scientific Research Institute of Livestock Breeding] constructed a thermos for shipping semen to be used but once; it was very convenient for large stations of artificial insemination. The thermos consisted of a box (of corrugated cardboard) and a polyethylene little bag, which is hermetically sealed after filling it with flasks of semen and an ice block. The space between the carton walls and the little bag is filled with heat-insulating material (shavings, sawdust, chaff, peat crumbs, and so on). The cost of the cardboard thermos is considerably lower than of that made of glass or foamy plastic, and its production can be easily organized locally; transportation expenses are also lowered considerably owing to the light weight of the thermos. But the main advantage is that the cardboard thermos need not be returned to the station, and this prevents the possible spreading of infection. The suggested thermos is useful for transport and keeping of semen at temperature 0° , but cannot be used for the transportation of frozen semen.

During the last two years, workers in animal husbandry show great interest in the new method of storing the semen without cooling, at a temperature of from +10 to +25°. Introduction of this method previously, when the use of sulfonamides and antibiotics in the storing of semen was not mastered, was not possible since at the cited temperatures microorganisms developed very rapidly and the semen became unfit for use. The method suggested by Van-Demark and his co-workers, in 1956-1957, for the keeping of the bull semen, in which bacteriostatic substances and carbon dioxide were used did not prove to be worth while. Checking this method on fecundity, both in our country and abroad, produced questionable results.

In USSR, during the present year, M. V. Sytina developed a "bicarbonate-phosphate" method for storage of bull's semen without cooling. In this case carbon dioxide, dissolved in the medium, is produced in a chemical way, by a partial decomposition of the bicarbonate, which forms a part of the medium. In addition to this, one succeeds in regulating the concentration of carbon dioxide more precisely and it keeps more stably. Already 100 cows were inseminated at the pedigree-cattle breeding farm ["piemkoz"] "Aleksandrovo" by this method (it can be used also in swine husbandry). The given method permits preserving ampules with semen not less than 4 days, without ice or thermos, in a simple box with insulating material. At the present time the suggested method is undergoing a wide production test.

Nevertheless, it does not solve fully the problem of preservation of the semen and cannot replace the method of its indefinitely long preservation in a frozen state, for instance, in dry ice at a temperature of minus 78°; this latter method is used in the work of the Central Station of Artificial Insemination of VIZH, by the Stations of the Ukrainian and Lithuanian SSR, as well as other institutions of the Soviet Union. This method permitted transporting the semen of bulls, exhibited at VSKHV [All-Union Agricultural Exhibition], to transpolar region (city of Noril'sk), to the extreme south (Tadzhikistan) and to foreign countries (Albania). [Begin p.97]

But dry ice is in short supply, and its production directly at the stations of artificial insemination is economically and technically inexpedient. Therefore it is recommended to use liquid nitrogen as a cooling medium with minus 193° as the boiling temperature (that is by 115° lower than dry ice); this permits preserving the semen. The experience of preserving the semen in liquid nitrogen exists already at VIZH and the All-Union Institute of Horse Breeding. The industry can furnish it in large quantities as a sideproduct in obtaining liquid oxygen. There exist small-size set-ups for compression of air, they can be furnished to the stations of artificial insemination. The only technical difficulty is the preparation of high-quality containers for conservation of the liquid nitrogen. High-quality containers with vacuum-powder heat insulation are known; they preserve the liquid nitrogen in the course of three weeks without overcharging. Organization of

Industrial production of such containers would considerably simplify the organization of artificial insemination of cows. Such containers, with liquid nitrogen and ampules with semen, could be delivered once in three weeks to the points of insemination and replaced with new ones, as the need arises. This will sharply reduce transport rehandling of the semen, and the three-week preservation of it locally, which coincides with the period of recurrence of the rut of the cows, will permit to inseminate each cow with the semen of a certain bull.

Along with this, it is necessary radically to improve the training of animal husbandry workers in problems of artificial insemination and breeding work, as the stations carry out the work with all kinds of agricultural animals. In view of this all the animal husbandmen must be familiar with the technique of breeding work and artificial insemination, whereupon the training of highly qualified specialists must combine deep knowledge of breeding work of different kinds of agricultural animals and of artificial insemination.

The most important and responsible problem, at the present time, is to develop a new system of conducting the breeding work at kolkhozes and sovkhoses. Within the next few years the breeding work in kolkhozes will be conducted with the aid of artificial insemination; this will permit discontinuing the use of low-quality producers and, on a large scale, actively and systematically to influence the reproduction by organizing a mass and rapid improvement of the breed and of the productivity of agricultural animals

in sovkhoses and kolkhoses. At the same time, in introducing artificial insemination it is necessary especially carefully to choose the pedigreed producers, clearly to plan the breeding work, to conduct accounting and records of the origin and productivity of the genealogical analysis of female herds, to organize a correct growing of young animals, its evaluation and record of productivity.

We suggest the following general system of work for breeding and artificial insemination:

1) the basis for mass improvement of commercial animal husbandry of kolkhoses must become the interkolkhos (cooperative) stations of artificial insemination, formed at the expense of kolkhoses (after the example of Ol'khovatskaia and other interkolkhos stations). Their basic problem is the improvement of cattle by means of a wide use of the best producers, which are obtained primarily from "plenkhoses". In the regions of commercial animal husbandry (milk, beef and wool) it is recommended systematically to conduct alternate crossing or to use semen from two-three breeds for the utilization of advantages of hybrid descendants. It is also desirable to have bulls and rams of beef breeds for obtaining early-maturing young beef animals from the less productive females. All the breeding work [Begin p. 8] on farms, serviced by such stations, must be directed to the formation of more productive, healthy cattle, which pay well for the feed, independently of the degree of thoroughbreeding.

2) in regions, producing pedigreed cattle, State stations on breeding work and artificial insemination must do the work; they should be formed on the basis of State stud stables, State breeding farms and breeding sovkhozes. These organizations having to do with basic blocks of thoroughbred cattle, which are improving the breed, should supply the regions of commercial animal husbandry with pedigreed producers. Therefore, it is necessary here to conduct highly qualified and systematic breeding work. In kolkhozes, which have breeding farms, all documentation about the origin of animals, conducting of pedigree records and of pedigree books must be centered in the hands of specialists, who conduct these records impartially. State breeding stations must conduct a centralized record of all inseminated animals in their region; whereupon they must be given the right to issue pedigree certificates and conduct pedigree books. In order that the initial pedigree record be absolutely correct, the insemination of kolkhoz cattle in regions of activity of State stations must be entrusted with the technicians of the station, who must draw up the initial breeding documentation.

For definition of pedigree qualities and checking of data about the productivity of kolkhoz thoroughbred animals, the State breeding stations must have highly qualified judges or experts. The expenses for their upkeep must be paid for by kolkhozes in the form of pay not only for the insemination of females, but also for the evaluation of animals, issuing of pedigree certificates, recording in the pedigree book, and so on.

For speeding up of the qualitative improvement of animal husbandry, it is necessary to raise the role of sovkhoses, which must furnish the semen of the best producers to interkolkhoz and State stations, or organize stations of artificial insemination, not financed by the State, for servicing the kolkhoses. At the present time the valuable producers in sovkhoses are utilized to 1-2%. These animals must be used to the full for the improvement of the kolkhoz cattle (with a load of from 2 to 20 thousand females per year, depending on their pedigree value).

In connection with the preminent transfer to artificial insemination new requirements are also set forth to the methods of the breeding work. First of all, the requirement in pedigreed producers will be reduced by 40-50 times. Kolkhoses, serviced by the stations, will stop buying producers and, in connection with this the pedigreed-cattle breeding farms will find it difficult to sell their ordinary thoroughbred material.

Along with this, the demands of the quality of pedigreed producers will grow exceedingly. Already now the stations on pedigreed-cattle breeding work and artificial insemination undergo great difficulties in acquiring pedigreed producers of required quality. The semen of mediocre producers does not find any market, and the stations must liquidate them. Later on, as the improvements in breeding work will proceed at the State breeding stations, the requirements in quality of producers will grow still higher. This must be taken into consideration by all the workers of the breeding farms.

Under new conditions the problem of evaluation of the producers according to the descendants also requires serious study. The workers of agricultural science must help the State breeding stations in the organization of systematic checking of the quality of the descendants of all the used pedigreed producers, of systematic development of card indices for the breeding accounting, of compilation and conducting of pedigree books, and in the greatest possible utilization of [Begin p.99] the most outstanding producers for obtaining from them not less than 20-25 thousand of descendants per year.

At the present time there are few producers in our country which were checked according to the descendants, but even the simple replacement of second-rate producers by the elite will produce a very appreciable result.

A mass introduction of artificial insemination into animal husbandry of sovkhoses and kolkhoses puts forward many difficult problems before the agricultural science, but at the same time it opens up prospects, that were unprecedented earlier, for a creative zootechnical work with huge masses of animals and creates possibilities for very rapid paces in improvement and formation of highly valuable breeds of animals in our country.

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Helicopter for the protection of plants
(A talk with the Deputy of the Chief Designer, V. A. Kuznetsov)

Zashchita Rastenii, vol. 4, no. 6, p.22-23.
Nov./Dec. 1959. 421 21

(In Russian)

Of late the helicopters are being widely used for the control of pests and diseases of plants along with airplanes. More and more farms express their approval for this type of chemical treatment as the most sensible and efficient, especially on broken terrain.

What are the prospects for the use of such machines in the near future? This was the question that the editorial office addressed to the Deputy of the Chief Designer, V. A. Kuznetsov. This is what he said.

Helicopter MI-1, developed by the collective under the leadership of the Chief Designer, M. L. Mil', was equipped with apparatus for the control of pests and diseases of plants, for spraying and dusting, about two years ago. Already the first tests, in orchards and vineyards of Crimea and of Krasnodar krai, have shown that the new way of utilizing these machines promised great advantages. Indeed, a helicopter does not need an airfield, it can take off from a small patch of land; this is especially important in zones of intense gardening and viniculture, where each hectare of the area is valuable. A helicopter spends considerably less time than

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the airplane for idle runs, for turns, and so on; it flies easily over broken terrain, where it is impossible to use not only the airplane, but also land equipment. Specific advantages of these machines became apparent. On the strength of their aerodynamic characteristics, the wave of the sprayed poison chemical is pressed to the earth by the descending streams of air from the rotor, providing excellent covering of leaves both on the upper and the under side, along the full extent of the tree or shrub. With the use of the airplane as it is known, a considerable part of the poison often drifts to the side, and the remaining poison, basically, reaches only the upper part of leaves.

Operation tests of the helicopter gave positive results and have shown the possibility of its wide application. Nevertheless, certain deficiencies were also discovered, which demanded improvement of the special apparatus. We took into consideration the remarks of farmers and of specialists of GosNIIGVF [State Scientific Research Institute of the Civil Air Fleet] and provided for improving the quality of the treatment. Thus, in the initial variant the spray booms of the sprayer were installed only at the sides; they did not go under the fuselage; therefore a narrow strip, a gap, remained along the center of the run, where the covering of the leaf surface was very weak. The defect was liquidated by installing injector nozzles under the fuselage on an additional spray boom. The construction of injector nozzles was changed for the

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improvement of dispersity of drops by using nozzles from land sprayers with eddy-forming devices. Special ejectors were installed for drawing off of liquid from spray booms; this permitted to avoid the inflow of the solution after the shutting off of the sprayer. The introduced changes substantially improved the work of the spraying and dusting apparatuses.

It is necessary to point-out that MI-1, according to its flight character, basically is up to the requirements for the exploitation on the protection of plants. It is completely safe, has a sufficient reserve capacity, can be filled with chemicals without shutting off the rotor; this considerably shortens the time of filling. Already now, as the tests have shown, its use in mountain orchards and vineyards is cheaper and more effective than all other methods of treatment. Nevertheless, the cost of operation of a helicopter is still very high and the designing bureau pays its basic attention to the improvement of this particular indicator. Since 1957, the resources of the machine (that is, the time of work without a capital overhauling) were increased twice and a further substantial increase is being planned.

The working load of the helicopter was raised considerably. It can now take 350 to 400 kg of poison chemicals instead of the former 260 kg. This was attained by increasing the sturdiness of construction and removal of equipment not needed for agricultural work. Productivity per 1 hour of flight has thus been raised by a time and a half and comprises, while spraying vineyards, up to 15 ha.

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As a result of this, flying only 4 hours per day (2 to 2.5 hours early in the morning and 1.5-2 hours before dusk) the helicopter replaces the work of 150 to 200 men. The productivity of the helicopter can yet be increased as a result of a more efficient organization and spacing of filling platforms [Begin p.23] near the treated sections, by the shortening of the flight course, and so on.

From the point of view of national economy, the universality of the helicopter and the possibility of its use all over the Union is of great importance. With this aim in view, we are developing a simple device, which will permit using our machine both in spring and in the fall for distributing poisoned baits for the control of rodents on the edges of fields and of water reservoirs. It is also expedient to use it in the fall for defoliation of cotton.

The design permits a quick re-equipment of the helicopter to a passenger, sanitary or mail variant; this will permit using it also in winter time.

There is a full justification for ascertaining that the light-weight helicopters, of the MI-1 type, will find a proper place in the practice of plant protection; and will permit making one more step ahead on the way of technical progress in this field. To speed up their introduction into agricultural production on a wide scale - this is the aim of our collective during these days, which precede the calling of the next Plenum of TsK KPSS [Central Committee of the Communist Party of the Soviet Union].

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Kolesnikov, A. V.

Izucheniye nukleinovyykh kislot u rastenii

[Study of nucleic acids in plants]

Akademiia Nauk. Vestnik, vol. 29, no. 3,
p.130-132. March, 1959. 511 Akil4V

(In Russian)

The Department of Biological Sciences of the Academy of Science of USSR conducted a visiting scientific Session at the Bashkir Branch of the Academy. In contrast to previous Joint Sessions of the Department with the Branches, where results of studies of natural resources of the specific territories were discussed, the Session in Ufa bore a doubly thematic character: it was dedicated to summing up the first results of the studies of nucleic acids in plants. Interesting data were obtained, during the past years, about the importance of nucleic acids in the carrying out of the most important vital functions of the organisms; and the Soviet biologists, who were occupied with the studies of nucleic acids, keenly felt the need for comparing the experience of their research, the newest data and defining further ways for development of the problem.

Over 100 men from Institutes of the Academies of USSR and Ukrainian SSR, from Bashkir and Moldavian Branches took part in the Session, as well as men from some other scientific-research establishments, Moscow and Bashkir Universities, Moscow Agricultural

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Academy"imeni K. A. Timiriazev", pedagogical and agricultural institutes. During the course of the Session (from November 25 to 28, 1958) over 30 reports were read and discussed.

While opening the Session, P. A. Genkel', Assistant of the Academician-Secretary of the Department of Biological Sciences, emphasized that the study of nucleic acids of plants is one of the new trends in biological science, which has many prospects, in so far as the detection of regularities of nucleic metabolism in plant organisms pushes forward considerably the solving of many scientific problems of physiology and biochemistry of plants. He expressed confidence that the Session will not only sum up [Begin p.131] the results of the accomplished research, but also will serve as a starting moment for the organization of systematic work, on the scale of the entire country, for the studying of this group of compounds, which play an important part in the life of the higher plants.

A. N. Belozerskii addressed the Session with a reviewing report "Nucleoproteins and nucleic acid and their biological importance". Reminding that, during the last 10-15 years, several works have shown the connection of nucleic acids with the processes of growth, reproduction, heredity and morphogenesis, as well as with the biosynthesis of protein, the speaker paid special attention to the specificity of nucleic compounds, mainly the desoxyribonucleic acid (DNA), and pointed out to the importance of working out the problem about the participation of ribonucleic acid (RNA) in the synthesis of protein.

A group of reports was given over to the detection of the nature and biological role of nucleic acids (A. S. Spirin "The chemical nature of the infectivity of plant viruses", I. S. Kulaev "Polyphosphates and their physiological importance", Zh. A. Medvedev "On the mechanism of RNA's reaction to aminoacids and peptides in the synthesis of proteins", and others). The speakers revealed the leading role of RNA in the definition of the specificity of plant viruses, gave certain data which indicate the connection of polyphosphates, insoluble in acids, with RNA. A supposition was expressed that polyphosphates, which are insoluble in acids, take direct part in the synthesis of protein and of nucleic acids, supplying phosphorus and energy for these processes. The results of research set forth in the reports showed the heterogeneity and different functions of RNA in the synthesis., depending on its localization in the protoplasm and organoids of the cell, activation and transfer of amino acids and peptides from one fraction of RNA to the other, permanence of the bond of RNA with peptides.

In a series of reports new methods of research on nucleic acids in plants were described (V. G. Konarev "About the complex-formation of RNA-pyronine", V. G. Konarev and S. N. Amirkhanova "Fluorometric method of definition of activity of ribonuclease", and others). A thought was expressed that pyronine, inasmuch as it possesses a specific affinity with RNA, which goes beyond the limits of the usual physical adsorption, and is capable of entering into reaction with it in a steady correlation, it can be utilized for a

quantitative cytochemistry of nucleic acids, for the study of the reaction of RNA with other components of the cell, as well as for the fluorometric accounting of RNA's depolymerization by various factors.

Reports were also presented, which characterized the role of nucleic acids in form development processes in plants (V. G. Konarev, N. V. Slepchenko and others). It appeared from the reports, that nucleic acids are centered in the most crucial organoids of the cell, that they constantly interact with the constitutional proteins of the cytoplasm and the nucleus and have a direct connection in the synthesis of a series of morphological structures of nonprotein nature. It was established that the stepped up concentration of RNA precedes the regeneration of the cellulose sheath on the surface of the plasmolyzed protoplast and in points of formation of secondary enlargements of the cell wall, in the forming of fibrovascular bundles. A task has been undertaken of a deeper study of mechanism of participation of nucleic acids in the formation of structures and products of specialized metabolism, determining economically valuable characteristics of plants, and, in particular, the role of nucleic acids in the formation of reserve nutrients. According to the report, made at the Session (by G. S. Kuramshin and V. K. Khangil'din), a vigorous accumulation of nucleic acids preceded the intense accumulation of dry substance both in the entire plant, as well as in its separate organs; this permitted speaking about the possibility of influencing the plant through nucleic metabolism.

Data, obtained up to the present time about the contents of nucleic acids in certain structural elements of the cell, were described in the report of M. S. Odintsova "Ribonucleic acid in structures of a plant cell". Attention was paid to the fluctuations of the amount of RNA in chloroplasts of young and old leaves, as well as to the high percent of content of this acid in microsomes (up to 9% to the absolutely dry weight).

In the reports of E. Z. Oknina "Nucleic acids in seeds of apple and cherry in the state of rest" and of N. A. Satarova [Begin p.132] "About nucleic acids in tissues of flower crops in the state of rest" it was shown that nucleic acids play an important role in the formation of reproductive organs, during their passing into the state of rest and their emergence from it. In a young globular seed and in the actively dividing meristematic tissue of the cell, the plasma of the cell and the large nucleoluses in nuclei are saturated with RNA, while DNA is concentrated in the nuclei. In proportion to the formation and growth of the bud the content of nucleic acids in it is gradually reduced, especially at the expense of RNA. In the passing of bud cells into the state of rest and cessation of cell division, the contents of DNA are reduced considerably and RNA disappears almost completely. Later on, in the germination of seeds a synthesis of nucleic acids proceeds from the decomposition of reserve nutrients. The rise in the contents of DNA and RNA before the emergence from the state of rest was detected both in buds and in bulbs of flower plants.

R. G. Butenko in the report "Intensity of synthesis of nucleoproteins in the upper shoots of soybeans and lupines, grown at a different length of day" pointed out the dependence of synthesis of nucleoproteins on the photoperiodical regime. As it proved to be, the synthesis of nucleic acids during a long day was always higher regardless of the photoperiodic reaction of the plant itself.

The effect of the environment on the contents of nucleic acids was established in the youngest and most active organs of the plant. M. A. Ali-Zade in the report "Effect of water regime on the content of nucleic acids in points of growth of a tea bush" cited data, which indicate that the water regime, considerably influencing the growth processes, has an effect also on the contents of RNA: the active or slowed down growth of the buds always responds to the rise or fall of its content.

Two reports dealt with nucleic compounds in the soils (I. A. Mazilkin "Nuclease activity of microorganisms of gray forest soils" and of M. N. Barangulov "About nucleic acids of soils". The ability of many groups of microorganisms to secrete ribonuclease was pointed out, also the dependence of nuclease activity on the microbe complex in that or another type of soil. It was shown that the content of nucleic acids correlates to the content of humus in the soil and that DNA considerably predominates over RNA in the nucleic complex of the soils. A suggestion was expressed, that nucleic acids play an important role not only in the phosphorus regime of soils, but also in the physico-chemical and biochemical processes, occurring in the soils.

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The necessity of further development of research on the following most essential questions was pointed out in the resolution, adapted by the Session: nature and biological role of nucleoproteins and nucleic acids in plants; biosynthesis of nucleic acids; their role in the phenomena of heredity; role of internal factors in the contents, distribution and condition of nucleic acids; effect of external conditions on the content and state of these acids; nucleic acids and plant morphogenesis; role of nucleic acids in the general and specialized metabolism of plants and in the formation of reserve deposits.

Attention was also paid to the necessity of improvement of methods (especially the quantitative) of studies of nucleic acids.

The Session recognized it expedient to entrust the Institute of Biology of the Bashkir Branch with the coordination of works on biology of nucleic metabolism of plants and expressed a wish to conduct the next session on this problem in 1960.

The Bureau of the Department of Biological Sciences approved the work of the Session and confirmed the basic trends of scientific research on nucleic metabolism, recommended by it.

Sukhoverkhov, F. M.

Metody i effektivnost' kormleniia ryby v prudakh

[Methods of feeding fish in ponds and their effectiveness]

Vestnik Sel'skokhoziaistvennoi Nauki, vol. 4,
no. 8, p.58-67 August, 1959. 20 V633

(In Russian)

In the Control Figures for Development of National Economy of USSR for the years 1959-1965, which were approved by the 21st Congress of the Communist Party of the Soviet Union, it is pointed out that the increase in the yield of fish will be achieved by utilization of new industrial regions in open seas and oceans, by a wide use of ponds, of lake-river reservoirs and water storage places, that were constructed in the country, which can produce annually not less than 6-8 mln centners of fish.

Developing the problems of nutrition of fish since the year 1935, we tried to find a possibility for utilizing in pond fisheries the wastes of food industry and of agriculture; those that are cheap, easy to transport and keep well. Oil cakes and wastes of grain crops satisfied these requirements, in our opinion. In experiments, during the year 1938, castor bean and hemp oil cakes, wastes from the screening of grain crops, as well as the dried flesh of mollusks were tested.

Candidate biol. science, Vserossiiskii Nauchno-Issledovatel'skii Institut Prudovogo Khoziaistva [All-Union Institute of Pond Fish Breeding]

It is known that fish, propagated in ponds (carp, trout and others) eat up well the artificial feeds and at the same time give a good increase,. According to certain foreign data (6,7,9) fish is fed rye, barley, wheat, peas, lupines, lentils, vetch, corn and industrial wastes in the form of the cocoons of the mulberry silkworm. It was established also (4) that carp uses artificial feeds as well as the warm-blooded animals do. As a result of feeding fish with wastes that were not used in the animal industry, in 1935, we, for the first time, obtained 14.6 c of fish per 1 ha of pond; that is, the yield of fish from a unit of area was increased considerably.

Later on, at the State fisheries of the northern raions of the central belt, as well as in the south of our country industrial experiments were conducted on feeding fish with various wastes. At fisheries in each zone 2-3 ponds were set aside, which had a natural fish productivity established for many years. Feeding of fish was done with two or threefold stocking of fish. The quality of feeds was determined according to the chemical composition, consumption and the size of expenditure of feeds per unit of increase of fish. In all cases the stock weight of the carp and its increase from consumption of natural food in ponds were excluded in calculations.

We conducted about 80 economic experiments when 30 kinds of feeds were tested. Experiments have shown, that the carp eats up willingly (without a thermal treatment) almost all kinds of oil

cakes, when they are given in a pure state; included are also those containing alkaloids (cottonseed and castor bean), as well as oil cakes of the mustard family, containing mustard oil, which cause renal and urinary bladder disturbances (rapeseed, wintercress) in warm-blooded animals, bitter oil cakes, which spoil the taste of milk (cameline seed oil, safflower), and oil cakes which have an unpleasant smell (perillic). The plain taste of fish is so great that in feeding Salmo irideus and carp (experiments of 1956) with feed mixes which contained 15% of the technical flour sweepings, poisoned with arsenic, no poisonings of fishes were noted.

Carp can utilize well different sweepings from macaroni mills, from hulling mills, elevators, bread factories, as well as wastes of grain, of combination feeds, of dough, which cannot be used in animal industry on account of some admixtures [Begin p.59] (earth, metal, glass), as well as wastes of rye, wheat, peas, vetch, lentils, seeds of Siberian acacia, and other crops, containing up to 40% of healthy seeds; it was established that seeds of weeds can be the basic feed for fishes.

Seeds of different plants contain sufficiently large quantities of nutrients. According to data of Mann (5) seeds of cockle contain: 15.3% crude protein, 16.6% fat, 58% carbohydrates; seeds of bindweed: 10.5% crude protein, 2.1% fat, 68.5% carbohydrates; seeds of wild lentils: 27.2% crude protein, 0.7% fat, 62.4% carbohydrates; seeds of common wintercress: 28.2% crude protein, 28.2% fat, 22.9% carbohydrates.

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It is possible to include in the feed mixes certain kinds of fresh animal feeds, which help in assimilation and better utilization of oil cakes, grain wastes and seeds of weeds. To the number of these belong: undesirable small fish, wastes obtained during processing of fish (at a moisture content of 75-78% they contain 14.4-15.8% protein and 2.5-4.2% fat), fresh blood, confiscations from slaughter houses, mollusks, tadpoles as well as frogs, which are obtained in water reservoirs. They contain a smaller amount of proteins (5.6-10%) and fat (0.6-1.8%), but the fishes consume them well in mixes.

Chemical analysis of oil cakes, taken by us for carp feeding, has shown that they contained an insignificant amount of calcium. At the same time it is known that salts of calcium and phosphorus are very important for the growth of fish. In 1950, we set up an experiment on feeding fish with feed mixes that were balanced in nutrients and in mineral composition. For this purpose we added chalk, which contained 51.2% of pure calcium to oil cakes; it is assumed that under the effect of gastric acid, particularly the hydrochloric, calcium becomes assimilable. Certain researchers (8) have maintained that the medium of carp's intestines is alkaline, and therefore the assimilation of calcium (in the form of chalk) is impossible. The others (3) doubted the changelessness of the medium of the alimentary canal of fishes. In our experiments we determined the reaction of the medium of the intestines of 50 carps with the aid of a potentiometer at different temperatures of

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water, using various feeds. It proved to be that the medium of the front part of fish intestines, at a temperature of water of 10° and lower, is neutral or slightly acidified, and is always slightly acid at temperatures of 15-20°. The medium of the second part of carp's intestines has a pH=6.5-7.4, depending on the kind of feeds; pH is neutral the most often while feeding on natural food, but in feeding oil cakes, which have lots of protein, and in the presence in the ration of 0.05-0.09% of calcium - it is acid (pH=6.4-6.8). After feeding oil cakes with the addition of chalk (contents of calcium in the ration are 0.52 to 0.68%) the medium of the intestines becomes slightly alkaline. It is obvious that the breakdown of food in the first part of the carp's intestines proceeds under the effect of acids; in this case calcium is absorbed in an ionized form. Since the digestion of food in fish occurs primarily in the second part of the intestines under the action of enzymes, which react on food in a neutral or alkaline medium, the feed must contain a sufficient amount of basic elements for the neutralization of the excess of acids, which form as a result of decomposition of protein. In the presence of fatty acids calcium, as it is known, forms insoluble calcium soaps (fatty acid calcium), which is emulsified by bile. In connection with this calcium can be absorbed in an alkaline medium in the form of an emulsion. [Begin p.60]

Methods used in our experiments on feeding fish in ponds were as follows: we put into a box the oil cakes, granulated in a

crusher, or the grist; we diluted in a barrel the pulverized chalk at a rate of 2% to the weight of oil cakes. This mixture we poured into the box with oil cakes, mixing it to the consistency of thick dough^{*}. The obtained feed was dropped down to the feeding places from spades or with the aid of a hand dump truck, mounted on a boat (figure 1).

Figure 1. Boat dump truck for distribution of feed to fishes: a) loaded (1- feed, 2- handle, 3- hinge, 4- boat); b) inverted.

The thick dough, lowered into the pond, absorbs water; as a result of this the weight of the feed is increased, and the moisture content reaches 78-80%. We added 2% of chalk to the feed mixes, besides this, in the experimental ponds. We fed fish at a twofold density of stocking. Both in the control and the experimental ponds the use of natural food, during various utilization of oil cakes, was approximately the same. Weight of the content of intestines of carp (food with the addition of chalk) as a rule, was smaller in experimental ponds than in the control ponds.

The obtained data on the growth of fish, that is on the utilization of feed for the increase of fish, have shown the possibility of reducing the expenditure of feed per unit of increase of weight of carp (table 1).

* For obtaining a thick dough the amount of water must be equal (in weight) to oil cakes. At such a proportion the moisture of the feed mix comprises approximately 54-55%.

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Table 1

Results of experiments on the reduction of outlay of feeds
per unit of increase of weight of fish

Years	Place where the experiment was conducted	Feed and feed mixes	Mean weight (g) of two-year olds in ponds		Expenditure of feed per unit of the increase of weight of fish in ponds	
			Control	Experimental	Control	Experimental
1947	Savvinskii fishery, Moscow oblast'	Cottonseed oil cakes (90%) + flax oil cakes (10%)	291	358	7.4	3.8
1949	Same place	Cottonseed oil cakes (100%)	356	378	5.9	4.0
1951	" "	Cottonseed oil cakes (100%)	476	496	5.8	3.6
1949	Fishery "Oktiabr'" Belgorod oblast'	Sunflower seed oil cakes (100%)	328	420	5.6	3.5
1951	Fishery "Progress", Kursk oblast'	Soybean oil cakes (60%) + cottonseed oil cakes (40%)	500	528	6.5	4.8
1954	Savvinskii fishery, Moscow oblast'	Seeds of Siberian acacia (90%) + flour-sweepings (10%)	380	460	5.8	4.6

[Begin p.61]

In the fall the mean weight of fish was higher, in all the experiments with the addition of chalk, than in the control. Reduction of expenditures of feeds per unit of increase of weight comprised 26-33%. The effectiveness of the addition of chalk to oil cakes was checked during different years in fisheries "Spartak", Kursk oblast', "Kliuchiki" and "October" in Belgorod oblast'. Addition of chalk to various moistened oil cakes reduced their expenditure per unit of increase of weight by 28% on the average.

In 1952 we determined the effectiveness of feed mixes, balanced according to nutrients and protein, in most of the fisheries of the RSFSR in feeding carp with the combined feed 4-r, consisting of 60% cottonseed, 20% rape and 8% flax seed oil cakes, 10% of grain mixture or flour sweepings and 2% of chalk (Table 2).

Table 2

Results of comparison of nutritiousness of the cottonseed oil cakes and of the combined feed 4-r

Indicators	Cottonseed oilcake	Combined feed 4-r
Digestible proteins per 100 g of feed	31.5	20.9
Sum of nutrients	68.7	66.8
Protein ratio	1:1.18	1:1.4
Ratio Ca:P	$\frac{31}{97.4} = 0:32$	$\frac{97}{97} = 1$

Expenditures of cottonseed oil cakes (without chalk) per unit of increase of weight comprised 6-6.5kg, and of combined feeds, similar in composition to combined feed 4-r, and which did not

contain chalk, - 5.8 kg per 1 kg of increase of weight of fish. Expenditures of the combined feed 4-r, on the average, at all fisheries of RSFSR were 4.2 kg per 1 kg of increase of weight of fish. Average saving (compared with normal expenditures) equalled 27.6%. At several of the fisheries ("Leninskoe", "Nara", "Osenka", Moscow oblast', "Niva", Voronezh oblast', "Dvurech'ie" and "Progress", Tambov oblast', "Para", Riazan' oblast') expenditures of the combined feed comprised 3.7-4.0 kg per 1 kg of the increase of weight of fish, and the saving of feeds 31 to 35%.

We also tested grist in fish feeding. Expenditure of grist per unit of increase of fish (under all other equal conditions) was higher than of oil cakes on account of a smaller amount of fat and considerably large losses in distributing the grist (the floury substances of grist do not fall to the feeding places but settle around them in the form of a cloud). Some agglutinants were begun to be added in the form of flax seed oil cakes, mill technical sweepings, rye or wheat flour dust, flour from grain wastes in order to reduce the losses of grist. In feeding carps with balanced feed mixes of different grists and oil cakes, under industrial conditions, the expenditures comprised: in feeds with predominance of oil cakes - 4 to 4.2 kg, and with the predominance of grist - 4.6 to 5 kg per 1 kg of increase of fish (table 3).

Experience has confirmed the high effectiveness of feeding carp different oil cakes and grists, which contain a fuller collection of amino acids. Feeding fish with one kind of feed badly

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influenced the increase; as a result of this its productivity was reduced.

Observations of Tsunts and Kronheim (23) have shown that plant feeds were badly utilized in threefold stocking of fish. Mixes of various feeds were comparatively badly utilized in our experiments in feeding carp only in sixfold and higher stockings. [Begin p.62]

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Table 3

Results of use of balanced feed mixes in fisheries

Fishery	Years	Feeds, balanced in mineral substances	Density of stocking (in multiplicities)	Area of feeding the fish (sq. m.)	Fish productivity (kg/ha)		Results of feeding	
					natural	total	mean weight of a two-year old carp	Expenditure of feeds per 1 kg of increase (kg)
"Oktlavr" Belgorod oblast'	1955	Mixture of different grists with addition of flour and grain wastes + 2% of chalk	6	142	350	2080	507	5.0
"Niva", Voronezh oblast' { "Mezhura", Kaluga oblast'	1954	Mixture of oil cakes + 2% of chalk	5	102	350	1968	549	4.0
	1955	The same	5	102	350	1978	510	4.0
	1955	Cottonseed, peanut, soybean, sunflower seed oil cakes and grists + 2% of chalk	3	200	240	661	500	4.2
	1956	Cotton seed grist, sunflower seed oil cakes and grist + 2% chalk	2	200	320	700	400	4.1
	1955	Mixture of various grists with the addition of grain-flour feeds + 2% of chalk	4	31	290	1151	520	4.6
"Nepreika" Tula oblast'	1956	Sunflower seed, soybean, rape oil cakes, cottonseed grist, grain-flour wastes, fresh animal blood + 2% of chalk	3	30	290	732	453	4.5

Apparently, in using balanced feed mixes the density of stocking can be increased, and instead of 6-7.5 c per 1 ha, 20-25 c of fish and more per ha can be obtained. In highly concentrated stocking the fish utilize feeds better, and the high natural fish productivity of ponds is attained in that case, when fish is fed strictly according to norms under conditions when the natural food in ration comprises not less than 17%. With such a ratio of natural and artificial feeds in the ration in ponds, that are not fed by current, 21 c of fish per 1 ha were obtained at the fishery "Oktiabr"; at the fishery "Niva" up to 25 c and in the finishing pond no. 3, which is fed by current, at the fishery "Kliuchiki" - 28 c.

At the fishery "Spartak", in a fivefold stocking of fish, 15-20 c of fish per 1 ha were obtained, whereupon the natural food, on the average per season, comprised a little over 20% in the total ration. In May the amount of natural food in the ration of fish is very great, then it drops, reaching the minimum at the end of June, and remaining at this level during the course of the entire August (table 4).

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Table 4.

Proportion of natural and artificial feed in the ration of carp at a fivefold stocking (in % to the total weight)

Months	Mean index of filling of fish intestines	Natural food	Artificial feed
May	3.0	90-95	5-10
June	2.0	50-60	40-50
July	2.2	15-20	80-85
August	2.8	10-20	80-90
September	2.2	20-25	75-80

The oxygen regime of water in ponds deteriorates during the second half of summer; the use of nutrients of the feed drops as a result of this. It was established, that with a denser stocking and correct feeding the natural fish productivity of ponds rises sharply. Increase in the yield of fish per unit of area during a dense stocking and feeding is attained not only at the expense of the feed, but also on account of a more intense use of natural food by fish; its use proceeds somewhat differently in dense stocking and feeding, than under similar conditions and at the same density of stocking but in the absence of feeding (2). Sometimes even at two or threefold stockings the fish do not utilize all the natural food. At the same time after the departure of chironomids or a mass dying away of zooplankton the fish often do not find sufficient amount of food even at a normal density of stocking. In the first case fish use more fully the supplies of natural food in ponds, and in the second, they feed normally and grow during the course of the entire vegetative period.

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During the first vegetative period, when the fish are still small, the supplies of natural food in ponds are not used fully. In denser stockings and feeding of fish the supplies of natural food are used better, and the natural fish productiveness of ponds is increased. During the second half of the vegetative period, when the requirement of food grows in the fish, the deficient amount of nutrients is compensated by artificial feeds.

Title of figure 2. Hydrochemical regime of ponds during feeding of fish. At the fishery "Spartak" (a cloudy day, August 18 and 19):

1 - pond no. 21 (sixfold stocking of fish); 2 - pond no. 8 (threefold stocking of fish). At the fishery "Oktabr'" (a cloudy day, August 20-21) in the pond no. 7 (fourfold stocking); 3 - section covered with duckweed, 4 - zone of open water.

Words in figure 2. At the top: O_2 in ml/L. At the bottom: hours.

Irregularity in the development of natural food during the course of the vegetative period [Begin p.64] can be used in the feeding of fish for obtaining maximum natural fish productiveness of ponds with the smallest outlay of feeds per unit of increase. For instance, at the kolkhoz "Imeni Lenin", Petrovsk raion, Saratov oblast', in 1953, in feeding carp with grain wastes and seeds of weeds (beginning with the second half of the vegetation period) 15.3 c of fish per 1 ha was obtained from a pond of an area of 5 ha; and only 6 c from the same area but with a natural fish productivity. At this same farm, although the feeding of fish was started late, the two-year old carps attained, on the average, 800 g of weight.

It was ascertained at the Savvinsk fishery of Moscow oblast that with a more intensive utilization of natural food by fish, chiefly during the first half of the vegetation period (with two-fold stocking), the natural fish productiveness of ponds has grown by 35-40%, and in threefold stocking - by 73-84% in comparison to the natural fish productiveness, obtained with normal stocking (estimated for natural fish productiveness) and without feeding the fish.

Many years of observations at the fishery "Partizan", Voronezh oblast', have shown that threefold stocking and feeding of carp have increased fish productiveness of ponds by 85-92% (table 5).

Table 5.

Effect of feeding fish in dense stocking
on natural fish productiveness of ponds.

Years	Density of stocking of fish	Fish productiveness (on the average kg per 1 ha)		
		Natural	From feeding	Total
1936, 1937, 1938 1939	Single, without feeding	249	-	249
1940, 1941, 1945	Threefold, with feeding	480	486	966
1943	Normal, without feeding	267	-	267

At fisheries "Kliuchiki" and "Oktiabr'", Belgorod oblast', natural fish productivity of the finishing ponds with twofold stocking increased by 40-43%, at threefold by 60-72%, and at fourfold by 75-92%. The worth of the increase of fish production at the expense of raising natural fish productiveness (as a result of dense stocking and feeding of fish) exceeds the cost of feeds,

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used for feeding the fish, as well as the expenditure of labor. Partial increase of natural fish productivity is connected with the fertilizing effect of fish excrements, the amount of which, at the usual moisture content (77-80%), surpasses the increase in fish by 22 times. It was established by experimental observations that with an increase, equalling 10 c per 1 ha, the amount of fish excrements comprises 22 tons, and with an increase equalling 20 c per 1 ha up to 45 tons per 1 ha. Analysis of fish excrements has shown that the unassimilated part of oil cakes, which entered the pond in the form of excrements, considerably surpasses the recommended norms of fertilizers for ponds in the amount of nitrogen. It was established that fish droppings contain many more biogenous substances (nitrogen [Begin p.65] and phosphorus) than poultry and swine droppings. According to our observations, with a single feeding, a fish remains at the places of feeding 1.5-2 hours; all the rest of time it is looking for food along the entire area used for finishing [or fattening]. The best time for distribution of food is the early morning (not later than the sunrise) when, as a rule, there is no wind. The feeds, distributed in the morning, are characterized by an increased content of oxygen and their use by the fish helps in the improvement of the gaseous regime of the pond water.

Our observations (in 1953) have shown that with the reduction of oxygen up to 0.5 mg/L a fish spends energy for obtaining it

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from air (it rises to the surface and swallows the air); as a result of this the carp not only stops growing, but also loses weight; during reductions of the amount of oxygen (below 0.5 mg/L), and this usually happens in the morning before sunrise during windless, cloudy weather, the night fishkills occur. A sharp ~~imp~~overishment of water in oxygen is caused, basically, by the decomposition of organic substances, as well as the nightly use of oxygen by hydrobionts. During clear sunny days the amount of oxygen in water is reestablished up to the normal saturation. In strongly concentrated stocking the medium becomes so impaired that fish consume the set out feed badly and do not assimilate it. It is possible to improve the condition of the medium by giving to the fish mixtures that are balanced in nutrients, in mineral composition and vitamins (which provide the smallest expenditures of the organism per unit of increase). In our experiments the best results in the use of feed were obtained in those cases when for 100 g of the feeding mix the sum of digestible substances comprised: for the yearlings not less than 70, for the two-year old fish - 65 and for the three-year old - 60. Protein proportion in the ration must be narrower for the yearlings (1:0.4 - 1:0.5), medium for the two-year old (1:1 - 1:1.5) and wide for the three-year old (1:2 - 1:2.5). Towards autumn these proportions must comprise 1:1.5 for the yearlings and 1:3 for the older age groups, since the accumulation of fat in the organism of fish proceeds more intensively at a temperature below 18°.

If there are not enough carbohydrates and fats in the feed mix, which are used by the carp at the end of summer for energy expenditure and the laying aside of reserve substances, then the fish loses weight. At the fishery "Niva", Voronezh oblast', in feeding (beginning on September 20 and up to October 10) of the two-year old carp with oil cakes, the fish in all finishing ponds lost more than 10% of weight. When a fish stops feeding the losses in weight are explained by the fact that its intestines are fully cleared, and the body tissues lose moisture in the curtailment of metabolism. During the second half of the season (at a reduction of temperature below 18°) food mixes with a wide protein proportion are required both for the improvement of growth and the raising of effectiveness of utilization of feed per unit of weight increase of fish, as well as for obtaining of a better quality (a higher content of fat in the flesh of fish).

In using balanced feed mixes, that include the required nutrients, the amount of outlay narrows down to the sustaining of normal active life of fish and the obtaining of production (increase), which was specified in the plan. In-sufficient feeding inevitably causes a reduction in the growth of carp and increases the outlay of feeds per unit of production. Some of the authors suggest standardizing the amount of feed for fish, depending on its weight (1, 9 and others). One cannot agree with these suggestions since the relative amount of feed consumed by fish is reduced with the increase of its weight (in proportion [Begin p.66] to its

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growth and increase in age) from 24% for the yearlings to 6% for the two-year old ones. We suggested to take, as the basis for the method of standardization, the daily increase of fish during the course of the season. We estimate the amount of feed according to the outlay per unit of increase of weight of fish and the amount of artificial feed in the total ration. For instance, if the mean daily increase of weight of a two-year old carp in June comprises 6 g, and the outlay of the feed mix per unit of increase - 4 g, then, at a threefold density of planting, one third of the increase will be provided by the natural food, and the daily norm per head will comprise 16 g ($6 \times 4 \times 2/3$); at a fivefold density, where the artificial feed in the ration will comprise $4/5$, the norm of feeding will be equal to 19.2 g per day per head ($6 \times 4 \times 4/5$) (table 5).

Table 6.

Approximate mean daily increase (in g) of yearlings, two-year old and three-year old carps with dense stocking and feeding.

Month	10 day periods	Northern raions (up to the 55th parallel)			Central belt (55-51 parallel)			Southern and south- eastern raions (to the south of the 55th parallel)		
		Yearlings	Two-year old ones	Three-yrs. old ones	Yearlings	Two-year old ones	Three- year old ones	Yearlings	Two-year old ones	Three- year old ones
April	3									
May	1									2
	2									4
June	3									6
	4									8
	2									10
	3	0.1	5	10	0.1	5	8	0.1	5	12
					0.2	5	12	0.3	6	14

(Table continued on next page)

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(Table 6 continued)

Approximate mean daily increase (in g) of yearlings, two-year old and three-year old carps with dense stocking and feeding.

Month	10 day periods	Northern raions (up to the 55th parallel)			Central belt (55-51 parallel)			Southern and south-eastern raions (to the south of the 55th parallel)		
		Yearlings	Two-year old ones	Three-year old ones	Yearlings	Two-year old ones	Three-year old ones	Yearlings	Two-year old ones	Three-year old ones
July	1	0.2	5	10	0.3	6	12	0.4	6	15
	2	0.3	5	10	0.3	6	14	0.4	6	16
	3	0.4	6	12	0.4	6	14	0.5	7	16
August	1	0.5	6	12	0.5	7	14	0.5	7	16
	2	0.5	6	12	0.5	7	14	0.4	7	15
	3	0.4	4	8	0.4	7	10	0.4	6	12
September	1	0.3	2	4	0.3	3	8	0.3	4	10
	2	0.2	-	2	0.2	1	4	0.3	2	6
	3	0.1	-	-	0.2	-	-	0.2	1	3
October	1	-	-	-	0.1	-	-	0.1	-	-
	2	-	-	-	-	-	-	0.1	-	-

On the basis of control catches, conducted during the course of many years, it is possible to compile a diagram of the mean increase of weight of fish for the given fishery and estimate the norms for feeding the fish. Our examinations of the contents of the intestines of fish, conducted at the fishery "Spartak", Kursk oblast', have shown that at a temperature of 20-24° the artificial feed (castor bean oil cakes with wastes of rye) is retained in the intestines of the fish over 20 hours. Therefore we recommend to feed the two-year old carp (at a 2-4 fold density of stocking) once per 24-hour day.

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Elubov, R. E.

Deistvie i posledstvie ioniziruiushchikh izluchenii
kobal'ta-60 na rost, razvitie i urozhainnost'
khlopchatnika.

[Effect and results of ionizing radiations of cobalt-
60 on the growth, development and yielding capacity
of cotton]

Akademiia Nauk Azerbaidzhanskoi SSR. Izvestiia, no. 5,
p.28-39. 1959. 442.9 Ak132

(In Azerbaidzhan. Russian Summary)

Summary, p.38-39

In recent years much research has been conducted on the clarification of the effect on plants of small doses of ionizing radiation from artificial radioactive isotopes "with indicator [tracer] activities" ["pri indikatornykh aktivnostiakh"]. The most important are the works of P. A. Vladsliuk [1], who proved that a preplanting treatment of seeds with small doses of ionizing radiations or the introduction of different isotopes into the soil facilitates the utilization of available nutrients, the conditions of metabolism, and a considerable increase in the yield and productivity of plants.

A. A. Drobkov [3], N. G. Zhezhe [4], A. N. Giul'akhmedov [2], O. K. Kedrov-Zikhman, A. N. Kozhevnikova, L. N. Plotashchik [5], on the basis of several years of field and vegetative experiments, conducted with natural radioactive isotopes under different soil-

climatic conditions with various crops, came to conclusion that the introduction of negligibly small amounts of radioactive isotopes under different agricultural crops produces a positive effect on the development and yield of plants.

We studied the influence of ionizing radiations of CO^{60} on the growth, development and productive capacity of cotton in the year 1956. The effect of ionizing radiations of CO^{60} on cotton (variety 108F) was studied under conditions of a small greenhouse. Filling of containers and introduction of fertilizers was conducted on June 23, 1956. Fifteen kg of mixed sierozem [gray desert soil] and meadow soil of the Udzhar raion (Shirvansk steppe) were placed into each container. The labeled cobalt nitrate CO^{60} was introduced into the soil at a rate of 250, 500 and 1,000 millicurie per container.

In two variants ordinary cobalt nitrate (1.02 and 2.04 g per container) was introduced along with the labeled cobalt nitrate. The effect of the ordinary cobalt nitrate was compared with the effect of the radioactive cobalt nitrate CO^{60} . Nutrients were introduced into all containers - nitrogen in the form of ammonium nitrate and P_2O_5 in the form of superphosphate at the rate of 6 g of the active element per container.

The planting was conducted on June 23, 1956. A planting was again made on June 3, 1957 in order to study the aftereffect of the radioactive cobalt. On the basis of conducted experiments one can make the following conclusions.

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Dvoriankin, F. A.

Obnovliaetsia li "klassicheskaya genetika"?

[Is classical genetics being revived?]

Voprosy Filosofii, vol. 13, no. 12, p.128-138.
Dec. 1959. Not in DA library.

(In Russian)

Of late the idea about the "revival" of "classical genetics" begins expanding ever wider in the scientific literature. This idea found its reverberation in an entire series of articles in biological journals, as well as on the pages of the journal "Voprosy Filosofii [The Problems of Philosophy]. Thus, for instance, in no. 6, for the year 1957, was published an article by N. P. Dubinin "Method of physics, chemistry and mathematics in the studies of problems of heredity"; in which is announced the "revival" of modern Weismannism (the latter, usually, in such articles is called differently by its followers, depending on the age of its revived theoretical principles: for the long past it is "metaphysics", for the recent past it is "formal genetics", and for the modern state - always and only "classical genetics"). The "revival" consists in the fact that the author, in the name of the trend, retracts a series of theoretical principles, which were defended by native "classical geneticists" against T. D. Lysenko, about twenty years ago, as the foundation of "dialectical materialism in biology" (see contemporary reports in print about

the convention at the editorial office of the journal "Under the Banner of Marxism", in 1939). How much indignation at that time was caused by the criticism of these genetic principles by the Michurinists. Indignation of the followers of Weismannism was caused also by the speeches of philosophers, who did not want to support Morgan's genetics as an unfolding of "dialectics" in modern biology; the theoretical exercises of G. Müller, were represented as such, for instance.

N. P. Dubinin calls the principles, that are defended now by the geneticist, as it really should be, metaphysical and mechanistic, but this forced acknowledgement he presents as a result of an independent progressive development of "classical genetics" without any conflicts. Nevertheless, the foundations of the same idea are still preserved: independence of the hereditary process from the life conditions of the individuals. "Classical genetics" no longer insists on the monopoly of the cell nucleus in the determination of hereditary characteristics, since many geneticists consider probable as additional and subordinate determiners (for secondary hereditary characteristics) also the role of the chondriosome apparatus, plastids and cytoplasm granules, containing RNA, and of other particles, which can be recognized as being capable ^{of} reproduction. The number of such postulated "determiners of heredity" does not change the general position: the organism is divided into two natures, the causes of hereditary characteristics remain individual and autonomous, independent of the general bonds

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in the world. With the exception of the modern chemical interpretation, the postulation of many phases of internal determination of heredity in cytogenetics is known from the prewar works of Darlington; division of the material basis of heredity into nuclear and plasmic was introduced as a result of the 20-years research on inbreeding of rye of G. Nielsen. But no matter how many individual types of "hereditary units" would be suggested, the idea proper of the possibility of hereditary transmittal only where there appears an ability for self-doubling, remains a denial of the true development by way of new growth. A reason for the admission of collections of secondary genes - "plastoma" and "plazmona" - was seen in the fact that a series of real hereditary characteristics did not conform to the scheme of "Mendelirovanie" [Mendelization] and could not, thus, be referred to the nucleus. The idea of A. Weismann which serves as a basis for the attribution proper of the function of determination of hereditary characteristics to the nucleus; was dictated by the tendency to substantiate the independence of heredity from the environment, which influences the age formation of individuals. The need for some basis of this idea gave rise to the hypothesis about the germ plasm; it, as though, could preserve stable characteristics owing to a simple equivalent division, which precedes full age development of [Begin p.129] individual-producers, and, therefore, is "not subject" to the influence of peculiarities of individual development. This criticism may seem to be "old", but it cannot become newer as

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long as modern Weismannists retain the same indeterministic explanation. Since the reproduction of complete organisms, with the entire aggregate of "characteristics" is accomplished by the nucleus of the gamete, according to Morgan's theories, and all the protein components of the cytoplasm, including also the "biocatalyzers"-enzymes, are subordinated to it, then, virtually, the theory about the monopolistic role of the nucleus remains the same as long as genetics leans to the idea of heredity [based] on immutability of "rigid structures" and the recombination of their sections. This, as before, remains a reduction of all forms of movement of matter to the initial quantitative mechanistic movement, to the denial of historism in the development of the causes themselves of evolution. This, as formerly, represents variability as autogenetic, independent of the character of influence of external factors on metabolism, independent of the previously occurred development (phylogenesis) inasmuch as it is expressed in the entire bodily organization of living beings, in the type of their metabolism, in the frequencies and proportion of growth and development, in the new form development reactions of individuals to the peculiarities of conditions of formation, and not alone in the composition of nuclear structures. Is the use of one term "material foundations of heredity" insufficient in order to consider the conception of heredity materialistic? This conception remains outside the historical outlook on nature since it does not recognize the qualitative development of the causes themselves of

variability.

No wonder that the "classical geneticists" insist so strongly on the idea that the combination of sections of DNA molecules with four different bases are so varied and numerous. This is the same calculation of the fact that the number of independent cases increases the probability of accidental expedient (adaptive) combinations, which can by themselves provide all the diversity of living forms for all the ages of evolution, and it remains for "natural selection" only to adapt to the single system of living nature whole series of successive changes, independent of the conditions of development of species, but which proved to be adaptive by accident. "Selection" here is not the moving power of the progressive movement, acting owing to the renewal of the "gradual multiplicity of living forms" at each new level of evolution, but is only the recorder of the events that occurred before and without it. This is a step back from even the classical Darwinism, a true carrying out of the idea, proclaimed by Weismann about the return from Darwin to Empedocles in order, under the disguise of formal recognition of a historical principle in biology, to refute it and leave in the problem about causes of adaptability of changes "a wide field for faith" (Weismann).

The conception of organic development, established by Charles Darwin consisted of the inheritance of tendencies for variability, that are caused by the conditions of life; it explains the successiveness of the adaptive changes, which are useful for the pre-

servation of the species (descendants) in a certain ecological situation, which is conditioned by the interaction of organic forms. Darwin's selection - is a variability of formation of complete individuals, changing during all the periods of their age. But in Weismann's conception of "mechanistic selection" the changes, in principle, do not depend on the peculiarities of ontogenesis and are, without fail, accidental for the conditions of life; therefore their adaptiveness is preadaptive and breaks up with causality. This is a preformistic, indeterministic "theory".

What progress then has modern "classical genetics" attained in comparison with this idea and utilizing the newest chemical interpretation of "genes"? What is its explanation of the causative connection between the previously selected accidental and the newly, accidentally originating mutations. They are not connected by the essential bond-historical successiveness, by the trend of changes. Denial of the principle of heritability of changes, acquired in ontogenesis, this is a denial of historical conditionality of consecutive adaptations, which lead to the progress of general organization. It cannot be based on the rigidity of structures of the "hereditary substance", since by pure reproduction of something similar to oneself can be "explained" only the constancy of living forms if it is attained by the immutability of heredity and invariability of relations of organisms to the environment. There are no conditions for such a constancy in the living movement of progress and differentiation of animals and plants. Here

constancy is achieved by the renewal of species in new generations under changing conditions of the environment, "development anew" (Lysenko). The primary adaptiveness of changes can be attained only by way of form developing reactions of individuals adequate to the effect of the environment. A mutual adaptation of entire living forms is achieved only by selection, which extends over the entire life process of generations. It cannot be predetermined by chance mutations, even if they were caused by the environment as a simple stimulus for an indifferent variability. [Begin p.130]

True, N. P. Dubinin reports that the "hereditary substance" is no longer described in "classical genetics" as an imperishable "philosopher's stone", which transmutes substances, but remains inviolable to change. The possibility of influence of external factors on the "hereditary substance" through internal change is permitted. It is spoken even about the possibility of admitting the dependence of the quality of mutations on the quality of factors causing them. But all this is only a wordy "approach" to the idea of unity of the organism and the environment, since its role again comes to a push from without, which causes random changes, which do not depend either on the character of activity of factors, or on the complex of conditions of existence according to directions. Moreover, it is known that in cytogenetics, even during prewar years, it was spoken of a certain dependence (but not of conformity) between the "mutagenic" factors and the frequency of "crossovers",

as well as of the increase of the percentage of mutations in irradiation of Drosophila by X-rays; it was written about this also in connection with the effect of polyploidy under the effect of treatment of plants with colchicine.

The theory of chance variation was at one time directed by the mechanistic materialism against the "plan of development predetermined by the Creator"; but, in fact, it never takes biology out of the faulty circle of preformation, since it represents evolution as a miracle of preadaptation (adaptation to future conditions of existence), inasmuch as the numerous series of adaptive changes, on which the evolution is built, do not have, as a nature of their cause, the results of evolution of the living environment itself of the organisms. If the geological conditions of existence of organisms on earth remained unchanged, and the requirements of selection did not depend on the qualitative changes of interactions between species, which are determined by the developing demands of the progressing new organic beings, then one could yet think, that the innumerable combinations, possible for organism structures, conditioning the form, can provide an adaptive evolution by a purely mechanistic selection, the most corresponding to the unchanging conditions of life. But the "conditions of existence" are not alone a complex and changeable value, but are also a progressing cause of a new variability. They are created in a "biological rotation", owing to the interaction of regularly changing geological conditions of life, which do not depend on

the animals and plants themselves, with other conditions of life, but namely, on "mutual relations" of organic species, which are progressing irregularly, and are replacing by their own selves the complex of species formations. Relations of species, new and "survived" from old historic natural formations, regulate by their own selves also the effect on organisms of abiotic, physical and chemical factors of the environment, "biologize" all the ecological factors of life. The mutual relations themselves of species depend on the accumulation of progressive changes in the general organization of beings, together with which change the demands and abilities of organisms. Whereupon the type of interrelations between the species, which determines by itself a qualitatively specific natural formation in each geological period, changes again, depending on the replacing of living forms, dominating during this period, which by their "way of living" impose the type of relations in the given formation of species to all others. Provision of such conditions of natural selection by changes, which do not depend on the developing conditions of existence, is simply impossible.

All this requires understanding the ecological factors as a material basis of heredity and of its variability, existing in the system of organization of the living environment, while the other, - the basic, physiologic-morphologic, - the material basis of heredity exists in the "nature of the organism", that is in the characteristics of corporal organization of beings as a whole, and, according to the progress of the scheme of the organism, this ma-

terial foundation changes qualitatively.

To reckon that in this complex system of interaction of the organism with the environment all the organic development can be provided by accidentally appearing and eternally acting recombinations of the links of molecules of the "hereditary substance" - this means to reduce the causes of self-movement of the living nature to the evolution of a chemical form of movement of matter and not admit the qualitative passages to new, higher forms of movement of matter. In this exposure of the metaphysical understanding of the world was the whole essence of the criticism of the mechanicism [or mechanistic materialism], which was expressed by Engels at the appearance of Darwin's theory of development.

"Classical genetics", retains, in the system of theoretical ideas, the theory of mechanical selection of Empedocles and the idea of Aristotle about an extraneous power, which animates matter. This ideal antiquity will remain as a preformation autogenesis so long as the "classical geneticists" deny the three Darwinist principles of the "historical method in biology": 1) adequacy of the variability in the "nature of the organism" [Begin p.131] which take up in their own way the "factors" of the environment (principle of "unity of phylogenesis and ontogenesis"); 2) adequacy of the variability in the nature of conditions of life, which cause gradual changes by its repetition (principle of "unity of the organism and conditions of existence"); 3) adequacy of the trend of the newly arisen successive changes in respect to the character of con-

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ditions of existence, which determine by themselves the preeminent survival and reproduction of organisms (principle of "accumulation of successive changes in the direction of selection").

Darwin's old ideas outstripped by far the theoretical level of the newest positivism in biology.

These principles, which were developed by materialism in biology, as a result of ancient studies of natural relationship between species and inside the species, and their relation to "physical conditions of life", which were tested by Darwin's analysis of practice of artificial form development, undoubtedly, are necessary for a causative explanation and study of heredity. They all are united in the well-known law about the heritability of new characteristics, which arise under the effect of the environment on the organism in the process of individual development of animals and plants. This biological law is understood incorrectly, in a limited way, if it is not extended to the recognition of the formation and acquisition by the whole "system of living nature" of new causes of development, which arise as the result of the evolution itself.

Without the recognition of this classical legacy of materialism in biology, the attempts to explain the character of heredity only from within the organism, the attempts to explain only morphologically (by structures) or only chemically (structurally-enzymatically) will always be unsuccessful. The search for organic "material bases" of form are not in vain: they will lead to success in the perception of

ways of origin of the living organic substance from inanimate substances - this is the problem of chemistry. But the living remains as such only in an organic system; it is necessary to look for causes of its evolutionary variability under conditions of a biological process.

Organisms are bodies which are subject to age and are directedly developing; their qualities change according to how the conditions of the environment direct the differentiation of the living body; the basis for the trends of this differentiation every time are the morphologically irreversible results of the preceding development. Structures and processes, conditioning the initial stages of the formation of substance of the living organism of a certain kind, can be simple and relatively constant, but their complexes very intricate. And, inasmuch as in the aging process they are the ones that act, and not their origins, it is they that acquire a similar, and even greater, importance for the determination of the species character and for different varying directions of all subsequent processes of the formation of individuals. All of them - the basic and the derivative components - are the only ones in the system which comprise the material bases for heredity; they determine the trends of further variability; the bases, which depend on the history of development of the organism from the accumulation of that which is acquired. The other necessary aspect, determining the heredity, is provided by the environment - conditions of individual development of the hereditary type in its single form - in individuals.

In this fact is the essence of our difference of opinion and not in the recognition or denial of successes of modern biology; this latter is always contemporary and is always developing through struggle.

If one judges from half-admissions, "classical genetics" stands on the "verge of great 'discoveries'" and plans to "openly" acknowledge (de jure) the inheritance of the acquired characteristics and the adequacy of variability in respect to the character of action of environment on the organism. But we will have to wait for this admission again for about thirty years. "Classical genetics" does not hurry with the admission of the newly arising realities and is afraid of simple materialistic truths, but it is very generous with the advertisement of the retarded and forced acknowledgements as their own discoveries - such is their style.

Behold, how they present the same miracle of preadaptation in a laboratory coverall of 20th century - as a great progress of "classical genetics" which, they said, opens up possibilities for directing the nature of organisms with the application of methods of mathematics, physics and chemistry to biological research. This is very flattering to the representatives of these sciences: at last they dragged out the "helpless" biology. But it proves to be, that they only drew it up to the old psycho-Lamarckian idea about heredity as a "mneme"; exactly this idea lies in Gamov's hypothesis about the "code of hereditary information", in which the will of progenitor-organisms is dictated to descendant-organisms. And at the same

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time the audience is dazzled by the message that the recognition of heritability of the acquired characteristics is equivalent to the recognition of the stream of information from the descendants to the progenitors, understanding that the word "progenitors" means hereditary plasma, and the word "descendants" - the organism.

There is not a single word mentioned in the article of N. P. Dubinin about the matter that the problem about the causative - effect, ["prichinno-sledstvennykh"] connections between heredity and environment in individual development was raised [Begin p.132] and experimentally solved by the works of T. D. Lysenko, D. A. Dolgushin and others; they examined (using a large collection of varieties), since 1926, the regularities of the phasic process of growth and development. There is not one word about the fact that a whole army of agrobiological researchers of the Soviet Union - on the one hand the followers of Michurin, and on the other the followers of Mendel - debated in print and experimentally. All the leading specialists and theorists of selection solved the question of heredity, applying in practice the theories, developed by them, to the work of socialistic reconstruction of fields and farms. And all of them sanctioned Michurin's idea about controlling the nature of organisms; they approved Michurin's trend in biology, adapted the principles of the theory of phasic development and broke away from formal genetics. Only the armchair and the laboratory geneticists, who oriented themselves to the "Western school"

remained with it; but they cannot even keep up the pace with it. Nothing is said that even the projects of new experiments, which were accomplished by foreign geneticists, whom N. P. Dubinin cites now, were caused by the decisions of the August Session, which engrossed the attention of biologists of the whole world in the problems of regulating the nature of organisms with the aid of the effect on the organisms of controlled factors of the environment.

In the main, N. V. Turbinin in his article "About philosophical problems of modern genetics" comes forward from the same positions (Journal "Voprosy Filosofii" no. 2, 1958). The same ideas permeate the article of D. F. Petrov "About certain philosophical problems of the doctrine about material basis of heredity" (in the same journal, no. 7, 1958). There is a point in dwelling in more detail on the essence of questions discussed in these articles, and first of all on the problem about the "material bases of heredity".

2. Truth and legends about material bases of heredity.

Could one, following N. P. Dubinin, N. V. Turbin and D. F. Petrov, consider the natural nonrecognition of the theory of genes as a "rejection of attempts to give a materialistic explanation" to nature's phenomena? Apparently not. As it is known, I. V. Michurin also agreed with the "theory of gemmules" of Darwin, which, nevertheless, admits a causative explanation of the inheritance of

acquired characteristics, but positively denied Morgan's chromosome theory. K. A. Timiriazev considered, in general, every theory about "hereditary units" as a survival of preformation. Charles Darwin thought that the rise of consecutive changes during all ages of life of individuals is the result of direct and indirect effect of conditions of life on the forming individuals but not a result of chance.

D. F. Petrov asserts that the doctrine about the "material bases of heredity" began with the discovery by G. Mendel of "discrete character of inheritance" and the discovery by him also of the "basic unity of heredity". But the history of biology does not confirm this: 1) phenomenon of the so-called equality of the first generation of hybrids and the "splitting of descendants into forms of the generators" was known yet in the time of Pallas (see I. I. Mechnikov); 2) the discrete character of inheritance was known long before Mendel, but was explained in all its significance in the theory of selection by Darwin; Darwin's entire theory of selection is based on the recognition of the possibility to isolate the inheritance of individual differences and bring their development to a full conversion of the initial form with the aid of selection; 3) in the works of Buffon, and differently by K. Wolf, ^{it was} spoken about hereditary ("generative") substance, which is separated into the conditioning conservative reproduction of hereditary characteristics and into being susceptible to the effect of the environment. This is the history of the problem which has

been dragging on for ages. It is ridiculous to date its beginning from Batson, who "discovered" G. Mendel.

Disputes about heredity have deep roots: beginning with the known works of Hippocrates, Plato and Aristotle (the eastern, more ancient, theories are not widely known) they were not conducted, by any means, around the question whether it is necessary to consider the internal structure and the composition of the "egg" and "semen" as a direct material basis for the reproduction of the parental type in the posterity ("inheritance") and the cause of development of a specific living form ("heredity"). Disputes ran in another direction: should one consider the characteristics of the "semen" or "egg" formed by the entire organism of the generators or formed independently of the body. Secondly, the disputes centered around the problem, should one consider it natural and necessary that under the effect of external factors arise new living structures and new hereditary characteristics, as, for instance, K. F. Wolf thought, basing himself on the studies of the egg and buds; or should one accept the "hereditary substance" ("rudiments of life" of preformism) as one that cannot be influenced by the conditions of the environment, as was believed by the opponents of Wolf. [Begin p.133]

At the present time the disputes proceed on the same plane as the discussions of K. Wolf with the followers of the theory of preformation; theoretically the new consists in the fact that since the time of generalizations of I. M. Sechenov (and, maybe, of

K. F. Rullier| yet another idea arose in biology: should one consider the material bases of heredity conditioned only by the intraorganism characteristics, only by "internal structure" of living beings or consider that material conditions of existence of organisms exist in the external environment, which acts on the organism and provides for their development, and are the second (equally necessary) material base of heredity in view of the fact, that it is impossible either to obtain, or preserve any living form outside a certain environment (K. F. Rullier, I. M. Sechenov). The material bases of heredity are produced in the "body organization" of living beings (Marx); they are provided in the form of material possibilities of development (Michurin); the other necessary aspect is provided in the material conditions of development, which are determined by the environment.

Materialism consists in seeing and representing nature in such a way as it is, without any preconceptions. It is not enough to recognize that heredity is conditioned by the composition and structure of the eggcell or zygote in order to be a materialist in biology. The main thing is to understand that the world is united in its materiality, and to see in the peculiarities of physico-chemical structure of organisms the result of not only direct causes, depending on the action of some organic substances on others in the organism, but also understand this interaction as the result of universal material bonds, to consider it the product of the whole history of development of the living in the

interaction with the environment. The history of development, which created certain systems of successive formative processes of metabolism of matter, which are feasible only in the presence of specific "internal" and "external" conditions, is expressed in a material phenomenon - the "organism".

But the old followers of the preformation theory have also based their ideas about the "history of species" on the hypothesis about "hereditary substance" ("immortal rudiments of life"), which survives earthly "catastrophes" and conditions all the future diversity of living forms. One should not hide oneself from history and conceal the origin of the bases of modern chromosome theory from this idea of preformation. Weismann's idea of heredity is called "classical genetics" because it "returned", in the definition of Johansen, "to classical views of Aristotle" from Darwin, "who corrupted the theory of heredity" (according to Johansen), by authorising the inheritance of changes, caused by conditions of life during all the periods of life of the organisms. But, according to "classical" views of Aristotle, the body of the being has the same relationship to the "hereditary substance", as a picture to the paint on the palette: they form the picture and not it them.

After Darwin explained the ecological causes, which determined the trend of successive changes in generations through the preservation of the most adapted (selection) and development, in this way, of entirely new living forms (varieties), biology centered

its attention on the search for ontogenetic causes of evolution (A. N. Severtsov); that is, of causes which cause individual deviations from the maternal type.

"Units of heredity" in the 19th century "revealed" absolutely everything, and G. Mendel only followed the "general vogue". Thus, Charles Darwin suggested the "hypothesis of pangenesis", in which he tried to connect in one theory the basic ideas about causes of directed individual development according to stages, about regeneration, about inheritance and acquiring of new characteristics under the effect of environment. De Vries gave his theory of "pangenes", K. Negeli - the theory of "Idioplasm", which was later adapted by Weismann, who, incidentally, then connected the "hereditary substance" with the chromosomes; their own theories about hereditary particles, "molecules" were presented by Haeke, T. Eimer and others; in short, Darwinists, Lamarckians, and pure followers of the idea of preformation, they all were occupied with these units.

The affirmation of D. F. Petrov that K. A. Timiriachev, as if, highly valued the discovery by Mendel of the "hereditary unit" is a deep fallacy. He only protested against the affirmations of "classical geneticists" (Batson and other of Mendel's followers) that Mendelism replaces the "antiquated Darwinism" and pointed out that the, preservation of characteristics in crossing, discovered by Mendel, removes the objection of Jenkins concerning the impossibility of development of new growth, inasmuch as they, as if, will

be put out ("levelled") by crossing a changed individual with an unchanged.

The true opinion of K. A. Timiriachev about absolutely all the theories of "hereditary substance" was such: "The same fate awaits, probably, the whole assembly of "ultraopticheskikh" [ultramicroscopic?] entities, by which certain scientists (Darwin, Negell, Weismann, de Vries, and others) as if tried to explain the facts of heredity, which attracted attention during the second part of the century, but, in reality, only paraphrased them [Begin p.134] in vaguer expressions". (K. A. Timiriachev, Works, vol. 8, p.77-78).

You see: "they tried to explain" but did not explain, but only paraphrased. This was the opinion of K. A. Timiriachev about this subject.

"All these attempts repress only the remnants of theories of preformation, emboitement and so on, which had such a wide distribution in the 18th century. As also at that time, these attempts represent instances of unlawful intrusion into the field of biological dynamics of the static mentality of morphologists, which was engendered by their obsession, as if a form can be explained by another form, preceding it and if the visible connection is, at last, broken, then one can just fabricate a series of unseen forms, and thus into infinity" (In the same work, page 78).

Does it then turn out to be that K. A. Timiriachev, without recognizing the "hereditary units", also "refused the attempt to give a materialistic interpretation to heredity", "to open the

tr. door to vitalism"? No, D. F. Petrov made a mistake by choosing such conception.

The search for organic material causes, conditioning the reproduction of the "general constitution", "internal structure" and "mode of conduct" of organisms was not by chance; not they themselves, but only certain theories were caused by the effect of imperialism; this refers only to Weismann's treatment of heredity as isolated from the regular development of the environment and based on the Malthusian "struggle of embryos". We can never say this about Darwin's "theory of gemmules". But as to the fact that all these theories still remained in the limits of remnants of the preformation, K. A. Timiriachev was right. These theories, both of Darwin and of the Neo-Lamarckians, did not take into consideration the results of development, and, particularly, did not consider the evolution of the organisms of living beings themselves and the importance of the evolution of methods of organization of substances into new dynamic systems of various types. These were "mechanistic" theories, since they followed from the idea that only the peculiarities of the organism, and then in a purely morphological ("structural") sense, can explain by their own selves all the heredity, as if it was capable of existing all by itself in any kind of environment. The other side of the unity was forgotten - the organism - the medium, which conditions by itself the realization of hereditary possibilities in ontogenesis, and which guides their further development by its direct action -

through metabolism (principle of "assimilation" of Lamarck) and by indirect action - through preservation and reproduction of individuals with adaptive characteristics and tendencies for development (principle of selection of Charles Darwin).

The theoretical biology of the predominant trend as yet only draws near to the understanding of the idea of K. F. Rullier and I. M. Sechenov that the organism represents in itself a unity of the general organization and the environment; that is, of the internal and the external conditions, which provide a certain form of a being.

Of course, this idea-biology's own dialectic penetration into the essence of that which is called an "organism", - must be specified, must obtain proofs in simple facts. Biology, since the second half of the 19th century, took two courses in the examination of the nature of heredity. One of them - Darwin's, Michurin's - led to research on the nature of the organism through its manifestations, through the conduct of organisms in a certain environment. This means that one must study the characteristics of biological bodies according to the type of relations of different organizations of the living to similar ones and of similar to different combinations of conditions; then the causes of form are perceived according to form developing reactions of organisms to the environment. This trend can be called "physiology of conduct", and in the Timiriachev's plan - ^{it is} its "experimental morphology"; these methods for studying the nature of organisms were used by Darwin, Pavlov,

Michurin, Burbank, Timiriachev, and is used by Lysenko and, essentially, by the entire agrobiological practice.

The second way - this is the physico-chemical research into the "internal structure" of the organism, which specifies by itself the physiological basis of that or another formation and conduct of individuals, of course, again only in a certain environment. In this way one could distinguish two trends: the morphological and the physiological. The first consists in looking for everlasting identification of certain structures by others preceding them, by forms, which anteceded in phylogenesis the contemporary one, and by structures of the embryo, which consecutively condition each other in the individual development. Or again one could proceed by means of physiological experiment, that is, seek the possibility of directing the process of metabolism; this would require their preliminary studies. Timiriachev considered possible and prospective only the physiological explanation of the internal organic causes of formation, but always connected with experimental morphology. He considered it hopeless to search for purely structural causes.

He hoped for "enormous success of the doctrine of enzymes", which seemed to him [Begin p.135] to be the key to the explanation of enumerable conversions of organic substance into living bodies". He paid special attention to the polarity of characteristics of the nucleus and of the protoplasm: "may be there would appear a chemical explanation for the above cited morphological

dualism - protoplasm plus nucleus: one would represent the basic material for obtaining the entire endless diversity of substances in the organism, the other would include the condition for accomplishing this differentiation" (in the same book, p.89).

One should not think, that the idea about enzymatic action of the nuclear matter and the whole physiological trend in the explanation of formative processes appeared only 5-7 years ago and was not known to anyone at the end of 19th century. One should not think also that, in 1929, T. D. Lysenko referred the phasic processes of ontogenesis to the category of internal biochemical conversions according to accidental assumptions and arbitrarily in his field and laboratory experiments, and the explanation of heredity brought to a certain type of internal and external metabolism.

All this was the result of the truly classical physiological trend in biology.

Where should the results of this physiological way lead, in the opinion of K. A. Timiriachev, who summed up the development of biology in 19th century? To the study of the "initial origin of substance in plants and animal", that is "the process of their nutrition". The completion of this process of seeking the material physiological bases was seen by K. A. Timiriachev in the uniting of both methodical trends - in the creation of "physiological, experimental morphology", which, controlling the nutrition, will "model" the organic forms. The physiologist can control the development

of plants by changing the composition of food (in the same book, p.91).

Here is a clear answer of Timiriachev to the question in what do Darwinists see the material bases of heredity. The followers of Michurin proceed in their research in their agrobiological way, by means of experimental morphophysiology; they examine the forms of the bond between certain combinations (by complexes) of material external factors and the form development, which are outlined yet in the process of individual development, which pass then into "variability, that lasts for generations", that is into the development of new forms of life. The gradual changes and sharp conversions of plant forms are disclosed also at the same time.

Physico-chemical physiology looks, together with cytophysiologists, for internal organic causes of conversion of substances and for a basis for development of a certain form. Agrobiological "physiology of conduct of the organism" studies heredity in a controlled field and laboratory environment; studies form development reactions of hereditary type on the environment.

They are not antagonists, nor competitors, but two methodical lines of a simultaneous development of two sides of the same question about causes of form development; these are two methodical trends, both equally necessary to biology.

But it is a different story, how the facts are interpreted, what the trend of the theory is, what is its service to the world outlook and to which one in particular.

The followers of Michurin are convinced, on the basis of experimental studies of productiveness and form development of organisms in a controlled environment, of the fact that every living form (the whole totality of hereditary characteristics, type of growth and development, type of reproduction) is conditioned by physiological metabolism. Therefore they cannot oppose their way of research to biochemical physiology and they never opposed it. They are only against reducing biology to chemistry. But, besides that, they also do not want to stand still in waiting until that time when physiologists and biochemists will be able, at last, to explain what type of metabolism explains the differences, say, between the most winterhardy wheat "Liutestsens 329" and the typical spring wheat "Liutestsens 62". The Michurinists, as agrobiologists in their specialty (and not biochemists), explain this from the point of view of "physiological conduct" in the light of the theory of phasic development. This explanation offers also sufficient understanding of the nature of heredity in its unity with the environment of formation, and permits finding a practical guidance for the controlling of the nature of organisms, that is their productiveness and form development of descendants.

But quite another matter is the unacceptability of the conception of an independent "hereditary substance"; it in principle includes in itself the division of the essence of life into a form, depending on the environment, but which is not essential to form development, and into a heredity, which does not depend on the

environment, but which also conditions the form.

Modern biology refuses looking for purely morphological "hereditary structures" - the genes, as corpuscles of "hereditary substances"; physiology proceeds along the way predicted by K. A. Timiriazev. Very soon, with the aid of physics and chemistry it will become convinced of the fact that one cannot attribute to any one individual substance (a component part of the organism) [Begin p.136] a monopoly for the organization of "self-reproduction", and, consequently, also a monopoly in the determination of inheritance. This is a function of the entire living organization, of the whole organism, of the entire self-reproducing and developing biological system. This is the result of successive phasic processes, a product of organic substances which are in interaction, a result of all processes, which lead to irreversible morphological age development of the individual.

Any separate substances, any structures in the composition of a complex living body are not able to self-reproduce outside the organism, as well as any of the simplest living systems - viruses and phages - specifically are inoperative outside the organism and are not composed of DNA alone. And on the contrary, even the extracted substances can play a specific role in the reproduction of hereditary characteristics, when they enter in a connection with the organism.

Michurinists consider the philosophy of dialectical materialism as the only true methodological key to the understanding of the

essence of natural and social phenomena. Therefore they acknowledge the opinion of Marx as unconditionally correct: "Any trace of different elements, as such, disappears completely in a living organism. Here the difference consists already not in a separate existence of different elements, but in a living movement of functions differing from each other, which are all animated by one and the same life. Thus, their difference itself does not precede, in a complete form, this life, but, on the contrary, itself constantly flows out of the life itself and as much again constantly disappears and is paralyzed in it "(K. Marx and F. Engels "From the early works" p.224).

Material basis of heredity (that is the basis of constancy of reproduction of a certain living form), this is the whole corporal organization of the multicellular beings, the whole cell, the entire complex of components, which stand below the cell of living structures; everywhere this organism base actually becomes realized (from the possibility of becoming a reality) only in conjunction with a definite environment.

As to the "classical genetics", it represents a transitory nonscientific system of concepts about heredity as about something separate from the organization of beings, which is left over only as a housing for the "hereditary substance", "that is, it is capable of its own evolution" (G. Müller). Its purpose was to draw up "convenient" hypotheses into which the facts of heredity could be "fitted", but the reasons of the historic opinion about

living nature would be excluded; also the idea of unity of the world in its materiality will be removed, as well as the idea about the general causative-effect connection among nature's phenomena. The direct cause, which gave rise to Weismannism, has been forgotten at the present time but the system of these ideas, hidden under biological terms impedes the development of the physiological trend in the study of heredity. Loading a postulate over another postulate, the Neo-Kantian trend in genetics retreats in parts, around borders, but preserves the base - "the theory of chance in variations".

It is known that formal genetics has renounced the initial concept about the "gene" as an unchanging protein molecule, "inductively" controlling the development of the individual. A switching to interpreting the effect of genes as enzymatic did not take place in view of the protein nature of enzymes and, consequently, their definite participation in the process assimilation-dissimilation. It was necessary to find a new unchanging support for the "reproduction of one similar to oneself", such as the "classical geneticists" consider the inheritance essentially to be. That is why a support for concepts in the same lines was sought for in the form of the "rigid structure" of the DNA molecule. And since the protein enzymes are synthesized also in the cytoplasm, an entire scale of subordinations between the nuclear substance and the enzymes has been invented in order somehow to establish a preconceived control of the nucleus over the proto-

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plasm through an "intermediary" - RNA. After that it was necessary to admit the autonomy of certain RNA molecules in order to explain cases of insubordination to the maternal heredity to the rules of Mendel as laws. But there remained remote interspecific crossings where these rules are realized only as an exception, consequently new assumptions became necessary, and so on.

Only one thing is forgotten in addition to this, that all the components of a living organism arise anew during the process of assimilation and dissimilation; that in the organism nothing remains unchanged and the constant here is fluid and is renewed by conversions. To represent any components of the age process of heredity's development as predeterminators of all the characteristics of the organism, which are inherent to a developed individual, - this then means to presume the possibility of transferring the influence of the descendants to the ancestors, since all the substances are produced by the organism.

We are deeply convinced that chemistry, after being engaged into the problems of heredity, will quickly put an end to the theory of unchanging structures and their mechanical combinations.

[Begin p.137].

Therefore when D. F. Petrov speaks about the necessity of development of an understanding of genes as DNA molecules "which have their own metabolism, connected with the environment, depending on it, and able to change in different directions under the

influence of various influences of the environment", then we can say calmly: this is a prophecy about the rapid end of the theory about the special "hereditary substance". The gene-enzyme, which takes place in metabolism, which is again reproduced in this metabolism, arising again in the evolution of a living being, which is directed by the influence of conditions of existence, which preserves the succession with the history of development of organisms, which permits new hereditary characteristics to arise - this already is not the same "gene" with which we began our controversy with the formal geneticists.

But the Michurinists did not have any intention to deny diverse qualitiveness of components of a living organism, to deny differences in the functions of organic groups in the process of internal metabolism and in formative processes. On the contrary, their agrobiological facts, their genetic experiments and studies of phasic development of the morphophysiological age process of plant development have permitted long ago T. D. Lysenko and his followers to ascertain that a living body is of different qualities genetically; that during the time of development the state of the organism changes since its biological requirements change, as does its selective relation to factors of the environment; that for the realization of the vegetative process other complexes of conditions are required than for the generative progress, and so on.

But let us return to the now existing "gene" and not to its as yet mythical conception. In fact it proves to be that the effect

of environment on genes, which is now recognized by "classical genetics" is only a wordy declaration, an illusion of the progress of genetics.

Thus, D. F. Petrov is indignant at M. A. Ol'shanskii (see no. 6 for the year 1958) that he does not want to see the difference between the points of view of Gamov and N. P. Dubinin; the latter "asserts that mutations arise under the effect of certain peculiarities of metabolism and that the mutagenic factors of the environment produce mutations through the change of metabolic processes in the cell". This triple tautology seems like an oath of loyalty to the idea of the unity of organism and environment; but further on come explanations in the footnote, which show that the dependence of mutations on the quality of the influencing factors must be understood, so to say", in the Pickwickian sense". If adequate hereditary variability is understood as a "presence of a specific spectrum of mutations, which corresponds to a certain factor in the environment and is conditioned by the very mechanism of the action of this factor", then such an "adequacy", as it proves to be, was established yet by V. V. Sakharov in 1938 (but, in fact, it was spoken about yet before him). But this "spectrum" turns out to be a group of differently directed changes, not characteristic to the nature of the factor that caused it; its role is to give rise to a mutation, but of which kind they will be, that is already the work of an accident. More than that, even when during an experiment changes are obtained known to be adequate to the nature

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of the environment, then they are explained by the "classic genetics" with the aid of a known subterfuge, with the aid of an assumption that the detected adequate changes already existed before the action of the factor. D. F. Petrov writes: "Thus, in utilization of low temperature as a factor, which increases the hereditary variability, and growing the treated material at a low temperature, which is critical for the studied object, it is possible to obtain a semblance of great purity of the emergence of forms with increased frost resistance". Now then, the direction of mutations is only an appearance. The environment here is just sorting that which has been created accidentally and by itself: "all the immutable forms, and the forms that were changed in other directions, die and only very rare forms, in which the mutations arose accidentally, which lead to an increased frost resistance, are preserved".

This is a typical "explanation", which you should, please, use in selection and in medicine in the style of "controlling the nature of organism" according to Dubinin and Sakharov. If there arise thermophilic, winterhardy, frost resistant races of organisms, or those resistant to antibiotics, the explanation is always the same; it excludes the causative-effect connection between the state of the environment and variability. It is such: different non-directed changes arise accidentally, but only those of them will remain which are suitable to the given environment, although they did not exist in the initial culture, so long as it was not sub-

jected to an effect. With such an "explanation" one can only "expect a favor" from the goddess of Chance, and the entire evolution becomes a miraculous picture because of a coincidence of amazing chances, which fall into the hands of the artificial or natural selection as soon as they are needed by a man or by the natural environment.

But if you ask the authors of such an explanation of chances: were the changes arising in the experiment actually taken into account, was it really found out if they proceed in all possible directions; was the survival of the known frost resistant plant during [its] emergence and the loss at the same time [Begin p.138] of the thermophilic [plant] in this environment taken into account or did any conversions take place? It will prove to be that nothing of the sort happened. Simply, after having obtained, at a low temperature, forms that were changed to various degrees, they, nevertheless, explain prejudicially that, apparently, there were present here some thermophilic variants which simply could not survive: in other words, that which they assume they offer as an argument for the proof of their assumption.

Such is, in fact, this myth about the revival of Weismann's "classical genetics", which at the present time has "recognized" the possibility of influence of external factors on the heredity through metabolism, and which has "discovered" (with a delay of half a century) the possibility of controlling the nature of organisms by means of obtaining rare, but accidental, although always adequate mutations.

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And this is presented as a "living reflection of dialectics".

But how arrogant are the "dialecticians of accidental unforeseen happenings" in their relationship to Michurin's doctrine, which has shown in its field practical methods of controlling the heredity! T. D. Lysenko, in their opinion, does not take into consideration the very important circumstance that this adequate phenogenetic reaction was conditioned by natural selection, which preserved the forms with such adequate reaction. It is known well that in those cases where the appropriate natural selection was absent in the past, an adequate reaction did not take place". Thus speaks D. F. Petrov. This means that which does not arise before selection cannot be produced by selection. Such is their "recognition" of Darwinism.

It is known well that selection has for centuries created different breeds by combining selection of horses for trotting with constant training and regime; selection for milk productivity was combined with a specific ration and a method of milking the cows; selection for the capacity of a hunting dog to make a point was connected with a constant care for the development of the new instinct, which is foreign to the initial nature, to "refrain" from catching living birds. But according to "classical genetics" it is well-known that selection only finds the new, which occurred before it and without it. The doctrine of Johansen, preached by D. F. Petrov about "genotypical" and phenogenetic" reactions of the

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organism is typical for Johansen, who was a Kantian; he divides the natural facts into the appearance - "phenomenon" and - the "essence", which is as if elusory to us. But facts of practice show that the "appearance is substantial" and "the substance appears" especially if one starts writing about philosophic problems of the doctrine about material bases of her^edit^y. There is no division, on principle, of the organism into a "genotype" or "phenotype" in which the latter changes adequately to the effect of the environment, but does not change the "hereditary substance" (this modern entelechy), preferring "rather to die" than include itself into "inappropriate factors". Evolution is not interested in those perishing on account of objection to include the changes of the external world that do not fit them: the history of development and of progress is not founded on them.

"Phenotype", in the best case, is only an idea about a single form of realization of the hereditary type, which corresponds to the characteristics of the given environment; a conception which reasonably contains only the reflection of the fact that each hereditary form exists in multiformity. And how can selection note and preserve an adequate phenogenetic reaction if it does not affect heredity? All the reactions of organisms are conditioned by their heredity; all of them express the response movement, acquired from the effect of the environment, at the basis of which lies the property of all living bodies - irritability.

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It is not proper to teach dialectic materialism with the aid of noncritically absorbed Kantianism of Johansen and on the basis of this to convict a Michurinite, T. D. Lysenko, who does not agree with the agnostics in the "failure of the attempt to give a materialistic explanation to adequate variability".

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For further technical progress [Editorial]

Zashchita Rastenii, vol. 4, no. 5, p.1-3.
Sept./Oct. 1959. 421 21

(In Russian)

Majestic problems of creating the economic-technical base of Communism in our country, which were set in the resolutions of the 21st Congress of KPSS [Communist Party of the Soviet Union] and of the June Plenum of TsK KPSS [the Central Committee of the Communist Party], have found the liveliest response in the heart of each Soviet citizen. Socialistic competition developed in mills and factories, mines, construction works, transportation, in kolkhoses and sovkhoses, in scientific-research organizations and structural bureaus for an early completion of assignments of the Seven-Year-Plan, for a further technical progress in all the branches of national economy.

The semiannual results, published in print, about the accomplishment of the State plan for development of national economy of the USSR for the year 1959, attest to successes attained in this matter.

They became possible, owing to the heroic efforts of Soviet people and the wise leadership of the Communist Party, which is confidently leading our people from victory to victory.

Nevertheless, the Soviet people are not used to becoming soothed by that which has been achieved. It is natural to them to strive ahead for conquering new boundaries in production, science and

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technique, and in the building of the communistic society.

Comrade N. S. Khrushchev pointed out in his speech at the June Plenum of the TsK KPSS: "A steady growth of productivity of labor is of deciding importance in the building of the communistic society... The fast and steady growth of productivity of labor and the high rate of development of national economy can be provided only by way of technical progress, on the basis of the best achievements of science and technique, as well as the leading experience".

The June Plenum recognized it necessary to center the attention on solving the problem, raised at the 21st Congress of KPSS, both in agriculture as well as in all other fields, namely, liquidation of hard manual labor on the basis of complex mechanization of cultivation and harvesting of cereal and technical crops, potatoes, vegetables and others.

One of the weak spots of this problem until the present time is, undoubtedly, the control of pests, diseases of agricultural crops and weeds.

An economic-technical base was created in our country during the years of the Soviet rule; it permits to realize, on a large scale, measures for the protection of plants from pests, diseases and weeds. Yearly, over 20 mln ha [hectare = 2.471 acres] are being treated by the chemical method alone. Industry puts out, in large quantities, over 100 kinds of various poison chemicals, tens of thousands of tractor, horse-motor and knapsack sprayers, dusters, combined machines, aerosol set-ups, bait-spreaders and aviation apparatuses for these purposes.

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The use of these facilities permitted, of late, considerably to reduce agricultural losses from pests and diseases. Nevertheless, the present needs of kolkhozes and sovkhoses are yet badly satisfied by the chemical and machine-building industries, and the scientific-research and design organizations conduct very slowly the work on production of more improved preparations and mechanisms.

For instance, preparations for spraying are put out with a small content of the active element - 5.5% DDT dust, 12% BHC dust, and so on. Coefficient of effective utilization of these poisons in dusting is very low - 25 to 15% and even less. Thus, it is necessary, in practice, to use large norms of chemicals and often obtain an insufficient effect. At the same time a series of new organic compounds, such as the wetting IET powders, polychloropinene, polychlorocamphene, ethylsulfonate, mercaptophos, zineb, captan, and especially the herbicides, for which the domestic technology of production has already been developed, were either not produced at all, or are produced in very limited quantities. Further lagging in, say, the preparation of enriched Hexachloran (with the content of gamma-isomer 90-95% and more), which is needed for the production of combined substances for seed treatment, and which reduces the expenditure of labor for the treatment of seeds almost in half; it also raises the yield of cereals by 1-2 c/ha [centner = 100 kg] by reducing the infection with diseases and by pests, as well as by its positive effect on the growth and development of plants. It

was established that, for instance, the application of one ton of mercuran, for the preparation of which 120 kg of enriched BHC are needed, preserves about one thousand tons of grain, while for corn the economic effect of this preparation is still greater. Besides this, the production wastes of the enriched Hexachloran (nontoxic isomers) [Begin p.2] are utilized for putting out other, very valuable, preparations for the protection of plants, namely, hexachlorobenzene, 2,4,5-T, pentachlorophenolate of sodium, trichlorophenolate of copper, and others.

It is quite obvious that further technical progress in the chemical method of control of pests, diseases and weeds is unthinkable without the fastest research and organization of production of new, more effective and economical poison chemicals, that are less dangerous to men and animals; for instance, herbicides for technical crops, systemic poisons against sucking insects, preparations of a complex activity, and others. Is it not that several years ago effective substitutes for copper sulfate were found - zineb and captan, as well as copper oxychloride, which permitted reducing the expenditure of scarce copper; Comrade N. S. Khrushchev spoke at the June Plenum of the TsK KPSS about the necessity of economizing it [copper]. But their mass production as yet has not been organized.

Expansion of the output of highly effective poison chemicals must be indissolubly connected with a correct and full use of the existing technique, as well as with the production of more improved and efficient new machines for the protection of plants. It

is not a secret that often, even in the presence of horse or tractor-drawn dusters or sprayers, the treatment of plantings is conducted manually from gauze bags. Precisely by such "method", for instance, were flax plantings treated with EDT at many farms of Pskov, Kalinin and Moscow oblast's. There are cases when the equipment is sent to those regions where it cannot be used. Thus, tractor-drawn duster-sprayers OKP-15 were sent to the former Velikolukskaia oblast'; for several years they were not used for their direct purpose, while, at the same time, in other oblast's there were clearly not enough of these apparatuses.

The matter stands very badly with seed treating machines of high productivity. There are very few of them on locations and very often the seeds must be treated on the farms in barrels, heaps or, simply, in the body of a truck. Many inventors and innovators (Isaev, Tarnovich and Starostin) suggested several valuable attachments to a grain-combine for the liquidation of this gap, as well as to other machines and to grain-loaders (Tarasov, Rider, Ratush, and others); but this is only a temporary way out of a formed difficult situation. Kolkhozes and sovkhoses are anxiously awaiting to receive as soon as possible the highly productive seed treating machines; and, first of all, even PU-3.0 in sufficient numbers. Scientific and structural organizations (TsNIIKhPROM [Central Scientific Research Institute of the Cotton Industry], Uz. NI2R [Uzbek Scientific Research (?) Institute for Plant Protection] and others) must, at last, produce a necessary machine for the mechanization

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of centralized treatment of cotton seeds with a preparation of a complex action and incorporation of this operation into the continuous production process at the cotton-cleaning plant; this machine will permit using this progressive method at any cotton-cleaning plant and, thus, will fully free the farms from this labor-consuming operation during the tense period of cotton planting.

Wide application of chemical preparations for the protection of cotton - for the control of weeds, defoliation and desiccation also requires the building of special machinery. In this respect a story about the sprayer-duster ODN, which was distributed by "Uzbeksel'mash" [Uzbek Agricultural Machinery Plant (in Tashkent)], even in 1949, basically for the defoliation of cotton is quite instructive. During the course of 10 years this combined, mounted machine was being worked over and improved, and now is put out under the brand OUN-4-6. In Uzbekistan alone there are over 7 thousand such machines in use. Experience of many years of exploitation shows that, basically, they are used not for defoliation and desiccation of cotton (these works are now done for the most part by airplanes) but for the protection of alfalfa fields and of cotton plantings from pests and weeds, and moreover mostly as sprayers, rarer as dusters, and very rarely as both forms simultaneously. Thus, for instance, in Andizhansk oblast, from March to June, 1958, daily 320 such machines worked on spraying weeds and mulberry trees, and from May to August up to 500 of such machines were used for the treatment of cotton, whereupon only 1/3 for dusting, and the rest for spraying. The question arises, is it expedient

further on to produce such combined machines for cotton-growing farms? Obviously, it is time to change to the production of separate mounted sprayers and dusters. This will permit reducing sharply the outlay of metal and reduce the cost of the machine. At the same time there should be produced more sprayers than dusters, approximately by 3-5 times. Heavy-duty blower sprayers OPV and OVM were produced for the mechanization of chemical protection of agricultural crops; last year they passed State tests and received positive appraisal; they, undoubtedly, represent a step forward as compared with OKS, OKP-15 and OV2-15. The new machines have great productive capacity, provide good effectiveness of treatment and each of them is serviced only by one tractor driver, who operates the working parts of the machine from his cabin. Apparently, the designers must do one more step ahead for the technical progress; render automatic the operation of the flow of working liquid depending on the height and thickness of tree plants. Later on it will be expedient to transfer attention to the production of mounted systems, which will permit carrying out the application of concentrated liquids and aerosols.

It is necessary for factories to organize faster the production of new, more improved apparatus for the protection of plants; to make them better and cheaper and to propagandize them wider; to increase the output of experimental lots for this purpose, as well as of advertisement posters, brochures, catalogues, and so on.

Agricultural aviation finds its widest application on the fields of kolkhozes and sovkhoses. More improved and powerful Iak-12, An-2, as well as the helicopter came in to replace Po-2A airplanes. It is necessary to speed up the development of special apparatus and facilities for mechanized loading, which will provide a higher coefficient of useful employment of poison chemicals.

Synthetic materials should be used much wider in the production of special machinery and apparatuses for the protection of plants. The first experiments showed the prospectiveness of textolite gears, caprone bushings and tips, vinyl plastic [viniplastovykh"] spray booms and valves, tanks made of plastic, and so on. Replacement of cast iron, brass, bronze and copper with these materials will prolong the time of service of the special machines, will reduce their weight and cheapen their cost.

As it is pointed out in the resolution of the June Plenum of the TsK KPSS, science must play a great role in speeding up technical progress in all branches of national economy. Further creative development of science and technique, in a continual link with practice of communistic building is the most important problem of all scientific-research organizations, of all Soviet scientists. Our scientists - [Begin p.3] entomologists, phytopathologists, bacteriologists, virologists, zoologists, chemists, mechanizers and other specialists - have done a great deal of good by developing methods of plant protection and having created preparations and machines necessary for this, but a whole lot has to be done yet for full liquidation of harvest losses in plant industry from pests,

diseases and weeds, and for the prevention of their mass reproduction.

It is necessary for the scientific organizations of our country, working for the protection of plants at the present stage of development of agriculture, to keep up a stronger connection with production, better to find out its foremost needs, strongly to direct their strength for the quickest solution of the chief problems and for fast introduction into production of all the achievements of the native and foreign sciences. Along with this, it is necessary, urgently, to work out methodical and theoretical questions, since they will permit opening the way to further technical progress. Unfortunately, one observes yet a lot of routine, inertness and technical lagging. For instance, the All-Union Scientific-Research Anti-Phylloxera Station has existed in Odessa for many years; it was called upon to develop methods for the liquidation of foci of the dangerous pest of the grape vine. This Station has done a lot of good in recommendations of control methods, but it paid very little attention to such an important question, as the development of an authentic method for the determination of infectiousness. And even now yet, as it was 100 years ago, in production they resort to such a labor-consuming, and, mainly, imperfect method as digging and examination of the root system of each bush.

Another instance. VIZR [All-Union Institute of Plant Protection] has an experimental base - Slavianskaya - in Krasnodar krai, at which it conducts experimental work, particularly on Eurygaster.

Yet the economic-technical possibilities of this base are very limited. It lacks many things, even the usual laboratory equipment, special machinery and constant supply of electric energy, and, naturally, it is impossible without this to conduct research at a modern scientific level.

It is time for scientific institutions on the protection of plants to pay serious attention to the equipping with modern apparatuses and machinery.

The June Plenum of TsK KPSS directed its attention to the coordination of scientific-research works. VASKHNIL [All-Union Academy of Agricultural Sciences imeni V. I. Lenin] carries out the coordination of research in the field of plant protection; yet it is in need of considerable improvement, especially, the coordination of research work on mechanization and the main thing - organization of control for the carrying out of decisions of coordination conferences.

Further technical progress in the protection of plants is closely linked with the training of cadres and the raising of their qualifications. Organizers of the control of pests and diseases of agricultural crops were chosen of late at many kolkhozes and sovkhoses; they were given special training at study courses, in agricultural technical schools, and some even in colleges. Such cadres must be formed at each kolkhoz and sovkhos and their qualifications must be raised systematically. The modern, ever more complex economic-technical facilities, which are used for the protec-

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tion of plants, require special deepened training of cadres; and not only of those who are directly occupied in this field, but also agronomists of other plant industry specialties, as well as the mechanizers, and even the managers themselves of the farms. They, who use the newest technical facilities in the fields, orchards and forests, who introduce into production the newest attainments of science and protect the harvest in a practical way, require daily help.

Having included themselves into socialistic competition, and having taken upon themselves new, increased obligations in honor of the forthcoming next Plenum of TsK KPSS, the workers, engaged in the protection of plants, will render practical help in the preservation of harvest from pests and diseases and in proper manner will meet the opening of the Plenum with new labor successes.

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Khokhriakov, M. K.

Mikologiya i prakticheskie voprosy fitopatologii

[Mycology and practical problems of phytopathology]

Zashchita Rastenii, vol. 4, no. 5, p.25-26.
Sept./Oct. 1959. 421 21

(In Russian)

Mycology, as it is known, is the science of fungi. It encompasses the questions of systematics, as well as of morphology, cycles of development, specialization, geographical distribution, variability, and other biological characteristics of fungi.

Modern mycology has attained importance in very many fields of national economy and science, in people's nutrition, public health, in veterinary medicine, communal economy, and so on. In the present article we will characterize its importance only in agriculture, and, mainly, in the field of phytopathology.

It is sufficient to say that phytopathology had its origin in the bosom of mycology, and later on isolated itself as an independent science, including sections on bacterioses, viral diseases and flowering plant parasites. The bond between mycology and phytopathology remained unbroken up to the present time, and at times it is hard to tell where the first one ends and the second begins. Already conducting of a correct diagnosis of a fungus plant disease presumes not only the presence of appropriate mycologic knowledge, but also sometimes the use of rather complex diagnostic measures (humid chambers, isolation of the fungus to a pure culture, artificial inoculation of plants, and so on). The

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bond between mycology and phytopathology remained unbroken up to the present time, and at times it is hard to tell where the first one ends and the second begins. Already conducting of a correct diagnosis of a fungus plant disease presumes not only the presence of appropriate mycologic knowledge, but also sometimes the use of rather complex diagnostic measures (humid chambers, isolation of the fungus to a pure culture, artificial inoculation of plants, and so on). The choice of appropriate measures for control depends on the correct determination of the pathogen.

At present mycofloristic research is conducted on a wide front in almost all the republics of the Soviet Union, as well as the accumulation of knowledge about the species makeup of fungus diseases and of their geographical distribution. This will permit defining more accurately the areas of fungus plant diseases, as well as the dependence of their development on climatic conditions and, in its turn, will produce data for conclusions about the expediency of quarantining individual diseases, as well as about the connection of fungal parasites of cultivated plants with the flora of fungi on weeds and wild plants.

However, the center of attention of modern mycology lies, nevertheless, not in the geographical investigation of the fungal flora, but in a deep study of the character of development of its individual representatives or groups, especially in the part of discovering different stages or forms of spore-bearing in the cycle of their development. Further on, it is important to determine the

range of infected plants, or specialization of fungi, their differentiation into intraspecies forms, physiological races, biotypes. It is also necessary to conduct other experimental research of their biological characteristics.

Studying the biology of living organisms in their development and in connection with factors, surrounding them, mycology examines fungi in all the phases of their development not only on the plant in question, but also on others too. Studying the variability of fungi, mycology solves both the purely theoretical questions, for instance the ways of form and species development or systematics, as well as the doubly practical ones. Thus, while studying in parasitic imperfect fungi the higher spore-bearing forms, which usually winter and, up to this time are unknown to science, mycology investigates the overwintering forms of the parasite and, consequently, finds out the sources of spring time infections caused by them, besides defining more accurately their systematic dependence. As a rule, additional reservoirs of infections are found in the range of plants infected with fungi.

Data, obtained as a result of this research, can serve as a basis for methods of control; for example, an appropriate tilling of the soil, destruction of intermediate hosts of certain species of rusts (of cereals, currants and others) or of weeds. It will be also possible, on the basis of these data, to recommend how to conduct certain crop rotations, in which the crops affected by fungi would return to the same field only after a lapse of time sufficient for the inhibition of the development of the fungus.

The practical importance of studies of fungi specialization is seen, if only, from the following two instances. Up to the present time formal systematics considered that ergot with large horns, which infects the ovary of such large-grained cereals as rye, barley and others, belongs to one species Claviceps purpurea Tul; while grasses with minute ovaries (foxtail, timothy grass, meadow grass, bentgrass and others) are affected by another species - Cl. microcephala Tul., which is characterized by minute sclerotia, and the manna grass by Cl. Wilsonii Cooke. Conclusions were made from this that ergot does not pass over to cereals from the cited plants. Meanwhile, as the research of L. I. Pshedetskaja (1953) on cross infection of a collection of grasses with different forms of ergot has shown, the latter quite easily infects any grass, changing the size of its sclerotia (horns) depending on the size of their ovaries. Thus it proved to be that all species of ergot on grasses are synonyms, that is, forms of one species, having a wide range of hosts. And this means, that it is necessary to control the disease not alone on cereals but also on other grasses; it is necessary to increase the eradication of grassy weeds, use a crop rotation, excluding the repeated planting of crops, which are infected with ergot, on one and the same section.

A similar example with the pathogen of potato canker - Synchytrium endobioticum Perc. Research of V. I. Potlaichuk (1951) has shown that here too, in spite of the high degree of parasitism of the pathogen, [Begin p.26] its specialization did not prove so narrow as it was supposed: it infected also some other repre-

sentatives of the potato family (Solanaceae) besides potatoes. A herbarial mycologist, approaching the problem formally, without the use of the experimental method of research, and having discovered S. endobioticum on tomatoes or thorn apple, would conclude that he has to do with a new species of fungus; and, having described it as such, not only would complicate the synonymy of names, but would also delude the practical men in agriculture. By considering the form of fungus on tomatoes as a separate species, which is unable to pass over to potatoes, the practical men, in such a case, would not organize appropriate crop rotations and would permit the planting of potatoes on the same field after the canker infected tomatoes; and in the case of discovering canker on the thorn apple would not pay any attention to this and would not undertake measures for the liquidation of the focus of infection. All this would lead to unpleasant results. Consequently, a more precise determination of the systematic status of the fungal parasite is of both narrow theoretical interest, as well as of perfectly practical interest. These instances show the unity of fungal systematics as theory with practice.

Data about ergot, cited above, show that fungi are changeable organisms, which change their morphology, depending on the external conditions and, first of all, on the factor of nutrition, particularly on the host-plant. Formal systematics of fungi considers, up to the present time, that if a fungus has been discovered on another plant, on which it has not yet been observed,

and if it somewhat differs morphologically from the previously known, that it should, as though without question, be a new species to science. But modern mycology considers that it is necessary to experimentally check in each case: if the fungus moved to the plant in question from another one, and if it changed its morphology in connection with it.

Research of the Laboratory of Mycology "Imeni Professor A. A. Iachevskii" of VIZR [All-Union Institute of Plant Protection] shows precisely that far less species of fungi exist in nature than are described in literature; that their classification, at times, is built on unstable, unessential features; it proves to be artificial, and in many cases needs a critical revision. Precise diagnostics of plant diseases can be guaranteed only by the development of natural classification of fungi with the attraction of modern methods of research.

Fungi, being unstable organisms, change not only under the effect of the substratum, but also of the geographical factor. Study of these characteristics in the development of parasitic fungi provides a basis for compiling zonal systems for their control. Thus, it was found out, that crown rust of grasses, which has common buckthorn as its aecidial host in the northern regions of the European part of USSR, has, besides this, buckthorn Pallas in North Caucasus, and in the Far East-Dahurian buckthorn.

Leaf rust of wheat in the European part of USSR usually overwinters in the form of uredomycelium on winter crops, but in Eastern Siberia, where winter crops of wheat are absent, it adapted

itself for overwintering in the stage of teliospores, which, upon germination in spring, infect the weed Leptopyrum fumarioides; and, from the latter, the rust passes over to the wheat. Therefore there cannot be a single instruction for the entire Soviet Union for the control of cereal rusts, but should be differentiated according to zones.

Thus, study of the cycle of development, of specialization, variability and other biological characteristics of economically important parasitic fungi produces a key to the solution of purely phytopathological questions about the methods of overwintering of the fungus, about sources of the renewal of the infection of diseases, about the range of affected plants; all this, in the long run, permits to establish methods for control of the studied diseases of plants.

Karavianskii, N. S.

Predposevnaia obrabotka semian kukuruzy
kombinirovannymi preparatami

[Preplanting treatment of corn seeds
with combined preparations]

Zashchita Rastenii, vol. 4, no. 6, p.42.
Nov./Dec. 1959. 421 21

(In Russian)

At the experimental farm of the All-Union Institute of Feeds, in kolkhozes "imeni Lenina" Ukhtomsk raion, and "Malak", Khimkinsk raion, in 1956-1958, for the treatment of corn seeds the 50% dust of TMD was tested in a combination with one of the following preparations: 15% heptachlor, 20% dieldrin, 10% aldrin and 12% gamma isomer of HCH, as well as zinc phosphide in combination with HCH, and mercuran.

From 20-50 wireworms were counted per 1 m² at the experimental sections. Shedding of seeds and sprouts, caused by their damage, comprised in 1956 - 20% and in 1957-1958 40 to 63%.

One should mention that all the preparations raised the energy of seed sprouting, and TMD with heptachlor or aldrin (200 g/c) and zinc phosphide with HCH (0.5 kg of each per 1 c) the most markedly (by 8-20%). TMD with heptachlor and zinc phosphide with HCH in the cited doses showed the best effectiveness in the control

Vsesoiuznyi Institut Kormov [All-Union Institute of Feeds].

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of pests. In the first case there were registered 3-9% of shedding of seeds and sprouts, damaged by wireworms; in the second case - 4 to 5%; damage to plants caused by the frit-fly was reduced by 15-37% as compared with the control. The greatest death rate of the wireworm (50-80%) was attained at a moisture content of soil (estimating from the full water capacity) of 40-60%. These preparations did not produce any negative effect on the growth and development of corn. The yield of green mass, grown on heavy clayey soil, increased by 25% (from 376 to 470 c/ha) in the variant with TMTD and heptachlor, as compared with the control. Production experiments, during the current year, on an area of 40 ha have confirmed the high effectiveness of TMTD with heptachlor; this provides a basis for recommending it for preplanting treatment of seeds of corn as a substitute for mercuric insecticides.

It was established by our research that the most favorable dose for mercuran, for treatment of seeds planted into light soils, was 100 g/c (development of plants is impaired with a larger outlay); and into soils, which possess a greater adsorptive capacity, 200 to 300 g.

Paramonov, A. A.

Nazrevshie voprosy fitogel'mintologii

[Urgent questions in phytohelminthology]

Zashchita Rastenii, vol. 4, no. 6, p.25-28.
Nov./Dec. 1959. 421 21

(In Russian)

Of late the control of nematodes (phytohelminths) acquires an ever more important meaning. It came to light that these parasites cause enormous, multimillion losses to the agriculture of our country, including also the hothouse industry; this is the result of the widening of zones of damage of the most well-known stem nematodes of onion and garlic, potato and partly of strawberry, and especially of the wide distribution of root-knot nematode; and also beyond the borders of their natural area - in the northern zone, where they established themselves in hothouses. It is sufficient to illustrate the above said by the fact that the root-knot nematode is now widely spread in Moscow's hothouses and on certain farms in the Moscow oblast'. It is quite clear that this is a direct result of unsatisfactory state of problems of prophylaxis of hothouses against them. This is also true for other species of plant nematodes.

Thus, the problem of limiting the zones of harmfulness of phytohelminths in our country is one of the first.

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Agriculture and business are interested in the studies of means and methods of spreading of phytoparasitic nematodes and in the development of measures which will inhibit this process. It seems necessary to us already today, for instance, to compile yearly oblast' maps of spreading of root-knot nematode at hothouse farms having in view, that new farms, and all hothouse combines, which are free from nematodes be advised of the sources of danger. This kind of work could be conducted by the Oblast' Agricultural Administrations. An urgent publishing of printed instructions on the prophylaxis of hothouses against root-knot nematodes^{is} also needed. One should bear in mind that phytonematodes are microscopic organism of high viability and the protection of hothouses from them is almost as delicate a problem as is the protection of farms (hothouses) from viruses, bacterioses and mycoses.

And how does this problem get on in practice? For example, the regime of transportations of onion and garlic on barges and in freight cars, as well as the regime of storage of plant production at the procurement points often is conducive to the distribution of onion-garlic nematodes. We had an occasion to observe a case of delivery of onions for scallion growing from Riazan' oblast' to one of Moscow suburban hothouse farms. The onions were dirty, with soil adhering to them. The onion nematode is capable of anabiosis. Is there anything remarkable in the fact then, that such shippings contaminate the tare, conveyance, freight cars, points of destination of the freight? It is time to think about the matter.

that it is necessary to include compulsory anti-nematode measures in the organization of transportation of agricultural products, which are subject to storage, as well as during their storage.

At the present time the question became ripe for the formation of a network of anti-nematode points under the supervision of agricultural agencies. It is necessary to study the fauna of phytohelminths, in order to have data for the organization of the internal quarantine - the foundation of control of the wide distribution of root-knot nematodes and stem nematodes, heterodera of cereals, potatoes and beets, citrus nematodes, and many other species; being, for the most part, polyphagous and capable of high ecological adaptability. [Begin p.26]

The next problem of first rate importance must be the studying of mechanisms of pathogenic effect of phytohelminths on the plants, especially the cultivated one. It is only of late that it became known that phytohelminths possess highly active ectoenzymes, which are capable of subjecting to hydrolysis the carbohydrates, to split proteins and lyse propectic [propektinovye] cell walls of plant cells. Under their reaction the plant tissues undergo complex changes; their normal physiology is broken; their biochemical characteristics change, and deep destructive processes set in. As a result of this arises an intricate complex of pathogenic factors. Nematodes, themselves dangerous to plants, attract the development of viral, bacterial and mycotic diseases. This load becomes too heavy for the plant and it dies. Nematodes, as

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a rule, do not leave the infected organ. They only move from one place to another. And only a full loss of a plant organ (for instance, of a tuber, of an onion bulb, of a garlic clove, and so on) makes them return to the soil and invade new plants or roots, tubers and so on. This is typical for many phytohelminths.

In connection with this one cannot help emphasizing that all or almost all counteractive means, known to us, as a rule, are not connected with an exact study of biology and phytopathology of harmful nematodes, physiology of the diseased plant and biochemical processes, which are caused by the vital activity of phytohelminths. Most of them are built on accidental empiricism. For instance, mechanisms and causes of action of nematodal chemical preparations are little known. Such a condition hinders intentional ["tselenapravlennoe"] production of such preparations. But it is a fact that many of them became nematocidal only because still yesterday they were insecticidal. But there is a distance of huge size between nematodes and insects. We need specific nematocidal preparations. It is the problem of NIUIF [Scientific Research Institute of Fertilizers and Insectofungicides imeni Ia. V. Samoilov], in connection with specialists, to produce such preparations on the basis of studies of physiology of phytohelminths.

Absence of developed knowledge of physiology of this group of parasites and of the diseased plant - all this determines one more leading characteristic of the greatest amount of modern "nematocidal" chemical preparations. The greater part of them are toxic to

the plants. This fact determines also the method of their use. We, as a rule, are powerless in helping the plants during the course of the vegetation itself. We wait for their death, for the removal of the remnants of the yield, in order to disinfect the soil after that. However, there is not a single preparation in existence which could exterminate the nematodes even in hothouses. Even chloropicrin produces only a temporary effect. Naturally, a thought suggests itself about the necessity of measures for treating the plants by controlling the nematodes during the course of the vegetation proper.

In connection with this, the necessary research was conducted at the Helminthological Laboratory of AN SSSR [Academy of Science of the USSR]. Nevertheless, the fact is that if during the periods between rotations we disinfect the soil and reduce the numbers of nematodes, then during the vegetation periods we are raising it unintentionally. Therefore therapy is urgently needed, especially for hothouse farms. The physiological research is aimed at just this. It is closely connected with studies of possibilities for treating plants for controlling phytohelminths. The ways for solving specific problems are set and are being partially realized. The cited laboratory tries to solve two basic problems: a) what are the best dates for the use of remedies on plants for the control of phytohelminths and b) on which principles the treatment should be built.

The answer for the first question is being successfully developed both for the open and the covered ground by way of studies of dynamics of the quantities of nematodes, in conjunction with the factors of such dynamics. The treatment is more successful when the number of nematodes is smaller. Exactly during such periods the therapeutic methods are the most effective. Under field conditions the number of phytonematodes undergoes regular fluctuations, which are now partly possible to determine prognostically. In the covered ground, and especially in respect to root-knot nematodes the problem is quite clear: the treatment is needed, first of all, at the beginning of the vegetation, before the appearance of buds, that is during the period of plant growth.

The answer to the second question was also partly given: it is more expedient to choose such chemical preparations, which do not produce a nematocidal effect, since they are usually toxic to plants also, but use a nematostatic preparation (by analogy with bacteriostatic); one that does not kill the nematodes, but inhibits their reproduction. Research, which was conducted in the cited laboratory, has shown that, apparently, [Begin p.27] there are many such preparations. Some of the thiocyanogen and salicylic compounds, which produced a nematostatic effect were tested in particular. Further on it proved to be that ammonium nitrate produced the same effect. Methods for its use were first developed for the rot nematode and later on for the tomato root-knot nematodes. It was found that dusting soil in hothouses with dry ammonium nitrate would be the most effective; in respect to tomatoes, for

instance, three times, using 80-100 g per bush (area of the root system of the plant) during the first half of the vegetation; before budding, approximately every 10-15 days (research of E. S. Turiygina). Observations have shown that the number of galls, as well as their size, was sharply reduced; this was connected with a sharp decrease of numbers of ova in the sex tubes of the parasite. These data permit to hope for the introduction of the cited method of treatment to the farms. Doses for treatment of cucumbers are being worked out now (T. Pokrovskaja). However, the hothouse farms themselves must take part in this simple and accessible work, determining the doses of saltpeter for the cucumber crop. It is possible that at different farms there will arise some variations in dosing. We think that the chief purpose of ammonium nitrate is the treatment of plants in discovered foci of gall nematodiasis of hothouse crops. Therefore at the present time the laboratory is working out a problem about an early diagnosis of the gall nematodiasis without the dislocation of the root system of hothouse plants. The method will be developed at the end of 1959.

The problem arises, what to do about the treatment during the period of budding? An attempt was made in the laboratory to use the auxins (growth substances) in combination with a leaf feeding for this purpose. Sodium salt of 2,4,5-trichlorophenoxyacetic acid (2,4,5-T) was used, according to a method developed by Iu. V. Rakitin and A. V. Krylov (1957), in the following

modification: 40-50 mg of 2,45-T per 1 L of water were used for the treatment of tomato buds. Ammonium nitrate, potassium chloride, extract from superphosphate and boric acid were used for leaf-feeding (S. G. Miuge, 1958). Such a treatment produced an increase in the yield of tomatoes, notwithstanding the presence of root-knot eelworms; this indicated the therapeutic effect, which increased the vital resistance of plants. These examples show that the course taken has justified itself, by using treatments with the aid of preparations, which inhibit the nematodes (auxins draw off the labile substances from the roots and cause a reduction in nutrition of root-knot nematodes) (Paramonov, 1954).

One cannot doubt that the treatment of plants to control phytohelminthiasis will develop also in other directions. They, of course, will be numerous. But only one thing is clear: treatment of phytonematodiasis of plants is necessary and that this trend is progressive, new and searching; it is closely connected with a deep study of physiology of phytonematodes, and the study of physiology of the diseased plant is inevitably connected with it. This complex can surmount the routine, which narrows the methods of nematode control only to the decontamination of soil. No, both are needed: decontamination of the soil between rotations, and a blow to the nematode during the course of the vegetation proper. Only a combined action, only a double blow, both during the rotation and between rotations, can produce a real and lasting effect. But this is not all yet. The moment arrived, when it is necessary to

think (at least in respect to hothouse farms) about including antinematode measures into the everyday and normal agrotechnics for agricultural crops. The control of nematodes must be conducted systematically, and not only at the time when the catastrophe has arrived: it must be one of the aspects of agrotechnics. And it is exactly in such a case that the control of nematodes will be truly effective in the plans described above. Extermination of nematodes, at least at hothouse farms, can be possible only on such a basis.

The nematode problems, which are discussed in this article, can be solved only on the basis of thorough theoretical research. So far such research has only been started. The helminthological Laboratory of AN SSSR did not as yet step out into practice. The very first steps in the proper theoretical research have permitted making the above cited first and modest practical conclusions. Development of our knowledge is necessary in the field of faunistics, systematics, functional and ecological morphology, special ecology of phytonematodes, their physiology and biochemistry. The prospecting research, the importance of which today is not yet quite clear, is also needed. But the scientific work, in all these forms, must be closely connected with the production. [Begin p.28] Only such bonds can overcome empiricism and help master the new, progressive methods of control of nematode diseases of plants.

At the present time it becomes ever more clear that nematodes are closely connected with fungi (micellar) and bacteria. A bio-

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cenologic complex-nematodes, bacteria and fungi acts in a first place in a plant. Coordinated works of phytohelminthologists, mycologists and bacteriologists, and even virologists is the next problem, which was not as yet planned.

Tarnovich, N. K.

Nekotorye voprosy mekhanizatsii zashchity
rastenii v semiletke

[Certain problems of mechanization of
plant protection in the 7-year plan]

Zashchita Rastenii, vol. 4, no. 5, p.17-18.
Sept./Oct. 1959. 421 21

(In Russian)

The 21st Congress of KPSS [Communist Party of Soviet Union] has placed before the workers, engaged in the protection of plants, a responsible problem - masterfully to organize the control of pests, diseases and weeds; fully to utilize this important reserve for obtaining additional yields of agricultural production. The providing of kolkhozes, sovkhoses and RTS [Repair tractor station] with production apparatus and machines is of great importance for the solution of this problem.

According to the preliminary estimates of the MSKH SSSR [Ministry of Agriculture of the UESR], it is projected that in 1965 35% of the area under cereals will be treated with poison chemicals, as well as all the sugar beet plantings, cotton, oil crops, orchards and vineyards, 75% of flax-"Dolgunets" [long staple flax], 25% of vegetables, 7.5% of potatoes and 10% of brush-woods. About 150 thousand tractor and automobile dusters and sprayers, as well as 45 thousand horse-motor and horse-drawn ones will be required for this purpose; 47 thousand machines for treat-

Head of the Laboratory of Mechanization of VIZR [All-Union Institute of Plant Protection]

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ment of seeds, 2.5 thousand bait spreaders, many soil and standing plants ditch-diggers, and so on.

A still wider application will be found also for aircraft sprayers, dusters and bait spreaders.

Development of systems of machines for the protection of agricultural crops from pests, diseases and weeds must be completed during the years 1959-1965. The growing needs of farms require that these machines be characterized by high productivity, that little metal ["metalloemkost'"] be used for their construction, that they should have power-operated working principle, which would reduce the expenditure of labor and would improve the quality of treatment. Special attention must be given to the production of low-volume sprayers, aerosol generators, heavy seed-treating machines for treating seeding material, to the mechanization of secondary processes (preparation of solutions, hauling of poisons, loading, and so on).

Scientists and designers are facing serious problems in solving this vast program. The problem-thematic plans of scientific-research institutions for the years 1959-1965 include the following problems.

Research on hydraulic, pneumatic and hydropneumatic methods of liquid dispersion and determination of best methods for the formation of dispersion systems; theoretical and practical solution of the problem of regulation of dispersity in the process of production of aerosols and of fine-drop atomization of liquid. Application of electrification and ionization of the air-liquid

streams in order to increase the coefficient of use of the working liquid and to reduce the losses of the smallest particles of chemicals. Development of methods of preparation of stable suspensions and emulsions with the aid of vibrators and sounds of high frequency. Making more precise the technological process of thermo-chemical treatment of seeds. Research on the technological process of depth fumigation of soil against phylloxera in vineyards. Research on the technological process of weed control in plantings of technical crops during the preemergence and post-emergence periods (with the use of screens for the protection of seeds of the basic crop. Development of typical machine units: pumps, reducing gear, poison feeders, mounted systems, and so on. Selection of anticorrosive materials, resistant to the effect of poison chemicals, [Begin p.18] studies of plastics and their use in the production of machines. Development and introduction into production of progressive technology, and so on.

Such are the theory and practice in the field of mechanization of the protection of agricultural crops in the years 1959-1965. Many collectives of engineers and scientific co-workers are occupied with their solution. GSKB [State Special Design Bureau] at the factory "L'vovsel'mash", GSKB-1 of the Moldavian Council of National Economy, SKB [Special Design Office] of the Leningrad Council of National Economy, GSKB on cotton, and others, together with VIZR [All-Union Scientific Research Institute of Plant Protection and VISKHOM [All-Union Scientific Research Institute

of Agricultural Machinery] have already produced a series of new designs for machines and apparatuses: 34 brands are now either being put out or are under production, 43 are in the stage of development or are being tested by the factories or by the State. The experience, accumulated both in our country, as well as abroad, is being extensively used in designing the new technical equipment.

One should point out that the mechanization of plant protection is being developed at an inadequate rate. The total volume of chemical treatment of field crops and orchards is considerably lower than in some foreign countries. While the basic field work: plowing, planting and harvesting are mechanized in our country to more than 95%, the protection of plants is only to 25-30%.

The cause for this lies, to a large degree, in the fact that agriculture does not receive enough technical equipment for the control of pests and diseases of plants. During the last 10 years only 50 thousand tractor sprayers and dusters were produced; by many times less than in USA. Production of these machines was not put in good order until the present time. Orders are placed in factories, which do not produce them basically. Building of one brand is sometimes divided among 2-3 establishments. Many designing bureaus of the country, for example L'vovskoe, Kishenevskoe, Leningradskoe are working without co-ordination, thus permitting unnecessary parallelism. As a result of this, agriculture receives expensive machines and apparatuses, not always of the proper quality and in insufficient numbers.

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The arisen situation in the production of technical equipment for the control of pests, and diseases of plants, as well as weeds, is intolerable. A speedy and radical improvement is needed in this matter. It is necessary to separate out specialized factories. This will help in raising the quality of the manufacture and reduction of the cost of machines for plant protection; will increase their output.

Realization of supervision of the activity of scientific-research institutions and of the State Special Design Bureau by the State Scientific-Technical Committee of the Council of Ministers will permit using the engineering force and the material-technical possibilities correctly and purposefully, generalizing the experience of their work and solving quicker the problems important for agriculture.

Mastering the achievement of science and practice, extensive introduction of mechanization will give the possibility to kolkhozes and sovkhoses to raise the effectiveness of measures on the protection of plants and sharply to curtail the damage, which is caused by pests, diseases and weeds to agriculture.

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Dzhiembaev, Zh. T.

K sisteme zashchity sel'skokhoziaistvennykh
kul'tur na tselinnykh zemliakh Kazakhstana

[Concerning the system of protection of agricul-
tural crops on the new lands of Kazakhstan]

Zashchita Rastenii, vol. 4, no. 5, p.20-23.
Sept./Oct. 1959. 421 21

(in Russian)

Over a thousand species of harmful insects and about 900 pathogens of diseases of agricultural crops are to be found in Kazakhstan. Such a variety of them is conditioned, to a considerable extent, by the great geographical extension of the republic and by the difference of natural and economic zones entering it. That is the reason why in the obtaining of stable and high yields a prominent role must belong to the control of pests and diseases based on a system of measures, which take into account the zonal peculiarities.

The northern part of the republic can be divided into five regions in the entomological respect (according to D. P. Aleksandrov). The first- Podural'nyi, or European. Here enter the administrative raions at the foot of Ural mountains of West Kazakhstan and Aktiubinsk oblast's. Pests of field, vegetable and melon-patch crops here do not differ from those to be found in the European

Kazakhskii IZR [Kazakh Institute of Plant Protection]

part of USSR. Both climate and soil favor normal development of millet midge, Apamea paludis, cutworm moth, Calliptamus italicus, grain moth and pathogens of smut, rust, root rot and other diseases. Into the second - the West-Siberian region enter the northern administrative forest-steppe raions of the Kustanai, Kokchetav and Pavlodar oblast's and the entire North Kazakhstan oblast'. Here the conditions are favorable for the development of Gomphocerus sibiricus and Paracoptera microptera, frit-fly, Lema melanopus, grain moth, leaf-chewing owlet-moths, cruciferous sawfly, leaf beetle, Phyllotreta; the same diseases are to be found here as in the first region. In the third, the Central Kazakhstan region, into which enter the raions of West Kazakhstan oblast, that are situated to the west of the Ural river, the central raions of Aktiubinsk oblast' southern and central raions of Kokchetav oblast', the northern raions of Karaganda oblast', left-shore raions of Pavlodar and Semipalatinsk oblast's and all the raions of Akmolinsk, grain moth, leaf-chewing owlet-moths are widespread, as well as stem borers, thrips, beet webworm, stem fleas, Aelia acuminata, Phyllotreta concinna, seed-eating weevils (Curculio Tychius and erytomas), alfalfa leaf weevil and Eurygaster integriceps. Besides the diseases, cited for the two first regions, here are also to be found fusariosis and ergot, virus diseases of potatoes, bacteriosis of vegetable and cereal crops. The fourth - sand and flatland erosional region (all the right-bank steppe raions of Pavlodar and Semipalatinsk oblast's central administrative

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raions of Kustanai oblast' and large areas of Akmolinsk oblast') is characterized by frequent dust storms, which cause soil erosion, especially during the winter and spring months. The pests here are the same as in the Central Kazakh region, but they cause a smaller damage. Stronger harm is done here than in other regions only to sunflowers and vegetable - melon patch crops by Opatrum sabulosum, to millets by Pardileus calceatus, to the mustard family by diamond-back moth, to cereals - by beetles of genus Anisoplia; outbreaks of reproduction of Calliptamus italicus and of beet webworm, of clover and wheat moths are also possible. The fifth - Altai foot hill region includes the entire East Kazakhstan [Begin p.21] oblast' with the exception of Zaisan basin. This region is characterized by a sharp vertical zonality. Here are to be found the same species as in the West-Siberian region; besides them, the pests of clover, as well as beet webworm, grain mite, larvae of scarabaeids are of importance. Focal distribution of pests is characteristic for the region in question, as well as for other mountain-foot regions.

There exist subregions in each of the enumerated regions, which do not differ sharply one from the other in the composition of basic pests. Whereupon one notices a decrease of moisture-loving species in directions from north to south and from west to east along the entire zone of reclamation of virgin and waste lands with the exception of the Altai foot hill region.

Everywhere, with the exception of the fourth erosional region, in order to accumulate and preserve moisture, grain crop rotations, requiring cultivation, are basically introduced: 60-75% are under grain crops, mainly wheat, and 15 to 20% of plowland under clean and serial [coultisse] fallows. At individual farms - grass crop rotations. It is thought that for the habitation of pests, with the exception of wireworms, impossible conditions are produced on fallow fields. But many pests will concentrate and overwinter constantly on the leading out ["vyvodnoi"] field of perennial grass plantings. At the same time one should expect their heavier development on plantings of spring wheat, during its continuous cultivation on virgin lands in the course of 2-3, and more, years. In such a situation the system of measures for the control of pests and diseases comes to a prevention of mass reproduction and their extermination by chemical means. Grain moth, wheat thrips, Aelia acuminata, frit-fly, millet midge and wireworm spend their whole life on the fields. It is hard to keep them away from plantings. But it is quite possible to reduce their number and not to permit their reproduction in quantity, taking into consideration the critical vulnerable periods of their development. It is important, for instance, to deprive of nutrition the caterpillars of grain moth by a timely shallow plowing of stubble on fields and by a subsequent deep fall-plowing. The famished individuals will not be able to overwinter normally; in the spring they will change quickly to pupae, from which will emerge less

fertile butterflies. The owl moths are very vulnerable also during the period of overwintering, which they spend in the upper layer of the soil. A mechanical destruction of overwintering places can also lead to a mass death of this pest. It will be necessary to resort to chemical means for their greater numbers, using DDT dusts or mixes of this preparation with vofatox. Deep fall plowing of all fields after harvesting must be the basic, compulsory measure for the reduction of numbers of pests of grain crops. The time of plowing, from this point of view, depends on the composition of pests in the specific field. With a large number of shattered grains and mass reproduction of caterpillars of the grain moth, the plowing must be conducted right after harvesting. The fields, which are heavily infested with Aelia acuminata and wheat thrips, must be plowed at later dates. The time of plowing is of no importance for grain flies and millet midges. The second compulsory measure is the eradication of weeds, burning of plant refuse and plowing of such sections in the late fall or early spring. The third measure (against the grain moth, millet midge, wheat thrips and grain true bugs) is a quick, timely harvesting of cereals without losses. A divided method of harvesting in this case has an advantage over the straight combine method of harvesting if it is carried out at the time of wax ripeness of the grain and the rows of grain crops are harvested carefully and on time (on the 2nd and 3rd day after mowing).

Pests of vegetable and broadleaved crops (corn, millets) hold on in the weedy fields, and, especially, if such fields are poorly cultivated and are seeded to grain crops. Critically vulnerable periods for the development of the cited pests are the times of feeding of caterpillars in winter, of feeding of butterflies and overwintering of caterpillars and pupae. Cabbage and clover moths overwinter in the stage of pupae, beet webworm as caterpillars, and cutworm moths as eggs. In spring they all feed on weeds since there are no plants yet on the plantations of corn and vegetable crops. Famine during this period leads caterpillars to death, and adult individuals to underdevelopment. Butterflies, which are deprived of additional nutrition of nectar, remain either completely barren, or deposit few eggs. Caterpillars and pupae overwinter in cocoons and cradles in the upper layer of soil. Destruction of their "dwellings" leads to mass death of the pests. The mustard family pests - pierids and diamond-back moths - are widely distributed on all arable lands. Overwintering is the vulnerable period for them. [Begin p.22] Eradication of remnants of weeds around plantings of crops of the mustard family moves back the time of appearance of butterflies on the plantations and, thus, prevents their early infestation of the young plants, when damage is dangerous. Cruciferae and beet true bugs and fleas, as well as cruciferae leaf-beetles and blossom-eaters are also widely distributed on all the arable lands.

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They appear early on plantations; in spring they feed on weed sprouts, and after that they move over to the cultivated plants. It is possible to reduce their numbers by eradicating the early weed sprouts around the plantings by mechanical and chemical means.

It is possible to control Opatrum sabulosum, which harms corn, darkling beetles and beet pest, which harm beets and sunflowers, by keeping the fields clean. In the spring the weeds must be eradicated before flowering: on the fields, on sections near the farms, along the roads and around the fields. As it has been pointed out already, in the absence of feed, in the form of nectar, many species of insects remain barren or deposit very few eggs.

After the removal of harvest it is necessary very quickly to remove post-harvest residue from the fields since pests finish there their feeding and overwinter. It should not be permitted to graze cattle on pastures near plantings: since locusts breed on "trampled" pastures. It is rather hard to keep destructive insects away from perennial grasses: they move here from new and waste lands, as well as from grass plantings of former years. It is necessary to harvest grasses before the appearance of buds in such localities for a systematic reduction of numbers of pests; and still earlier during the appearance of pests in large numbers.

It is important to conduct the harvesting on time during the year prior to the year when the planting is left to go to seed for the control of pests of alfalfa flowers and seeds; this will lead to a considerable reduction in the number of seed-eating weevils and blossom pests.

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Control of wind erosion of soil is the basic requirement for agriculture in the fourth agricultural entomological region. Grass crop rotations will be introduced here, predominantly of perennial grasses - up to 40-50% of the plowed lands and clean serial [coulissee] fallows. Large areas will be occupied by crops requiring cultivation (sunflowers, corn, and others). Vegetable - melon patch crops will be allocated preferably in the river valleys. Agricultural measures for the reduction of harvest losses from pests and diseases here must be similar to those in other grain crop regions, but the conditions for their carrying out are considerably more difficult. Almost all the agricultural measures, directed for the reduction of the damaging effect of dust storms, will help in the development of those species, which are found here now in comparatively small numbers, and among them - grain moths and the wheat thrips. Exterminating measures must be conducted against them.

In the zone of virgin lands of Kazakhstan the grain crops are badly damaged by susliks [pocket gopher]; among them the mostly widespread and numerous are the Citellus pygmaeus and C. erythrogastrus Br. At the present time the method of poisoned baits has been widely used for the extermination of these little animals. Susliks do not like to invade plowed lands. After the plowing of virgin lands, they concentrate in great numbers around the plantings; they should be exterminated in the early spring on these sections.

Mouse-like rodents are widely distributed in this zone: Lagurus lagurus Pall. and Microtus socialis Pall. - species, which are capable of mass breeding during favorable weather and on fields that are weedy and improperly harvested. It is necessary to conduct dusting of plants with intestinal poisons and spreading of poisoned baits, made of grain and green plants, in order to control them.

In recent years, in the grain region of the republic, a spreading of smut, especially on wheat plantings, was observed. The basic cause of this is poor provision and bad quality of treatment of the mass of seeds, which are mostly brought in from other places and are not free from smut spores.

Thermic disinfection must be used for the control of smut. A system of preventive measures must include the following. Replacement of strongly infected varieties by new, highly productive, which are resistant to diseases and are adapted to local conditions; formation of a healthy seed fund. For this purpose harvesting, stacking, threshing and storing of the harvest must be conducted in such a way that the mixing of grains, the healthy and the infected, which were harvested from sections that were contaminated with smut and ergot, would not be permitted; approbation of and strict rejection, according to the degree of contamination with diseases. Timely harvesting of seed sections and improvement of the process of the combined method of harvesting, since the grain,

which was mechanically damaged, if left standing too long, [Begin p.23] becomes infected easier with harmful fungi (fusariosis, helminthosporium); drying, cleaning and sorting of the newly harvested grain. Disinfestation of grain storage places and granaries, of packing material, tarpaulins and other implements, as well as seeders, harvesting and grain cleaning machines. Setting up of favorable conditions for the growth and development of plants (introduction of mineral fertilizers, leaf-feeding). Late fall seeding of spring wheat is being successfully used in recent years at many farms for the same purpose. Introduction of a correct crop rotation, collecting and destroying of the infected parts of plants, as well as selection of healthy ears for seeds are of primary importance for the control of boll smut and nigrosporiasis of corn.

In order to prevent damage from rust to plantings, special attention must be given to keeping up of a high level of agro-technics and conducting of sanitary measures (elimination of wind-falls, deep fall plowing, eradication of weeds, space isolation of winter crops from the spring ones).

Transpiration of winter crops can be prevented by the elimination of infected residue, by spring top dressing with phosphorus and potassium fertilizers, spring harrowing, seeding with healthy, well filled seeds, timely harvesting of the yield, drying of seeds. All these measures create conditions, which limit the development of diseases.

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The total volume of agricultural cultivation, use of methods of agrotechnique for the reduction of numbers of pests and development of diseases, along with the use of chemical measures, in special emergency, will reduce as much as possible the loss of the yield from pests and diseases.

Trans. A-1120
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Dunin, M. S.

K diskussii o silikatnykh bakteriyakh

[Concerning the discussion about silicate bacteria]

Zashchita Rastenii, vol. 4, no. 5, p.29-32.
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(In Russian)

During the last 5-6 years the question about silicate bacteria began to attract the ever increasing attention of Soviet scientists and practical men in connection with the works of Professor V. G. Aleksandrov (1953, 1956, 1958 and other), of Kosareva (1956), Gorokhovskii (1957), and of some other researchers, including also many phytopathologists (T. I. Fedotova, 1957, V. I. Krivchenko, 1957 and 1958, S. U. Petrukovich, 1958, E. V. Chemodanova, I. P. Maksimova, 1958, B. Chelo, 1959, and others). Taking into consideration the contradiction in the opinions about the effectiveness of these bacteria, the editorial office of the journal "Zashchita Rastenii ot Vreditel'ei i Boleznii" has offered its pages for a wide discussion. We are giving here below a concise review of its results, both according to the published data, as well as to certain others, which reached the editorial office. Let us point out right here that in all cases the question is about preparations of silicate bacteria which were prepared, mainly, at the Odessa Agricultural Institute and by VIZR

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[All-Union Institute of Plant Protection], and which were introduced into the soil with fertilizers, with the irrigating water or with the planting material and seeds.

Introduction of silicate bacteria into the soil together with fertilizers and during watering. In 1958, Professor Aleksandrov made public the results of 12 different sectional experiments and production tests of introduction of silicate bacteria into the soil simultaneously with organic-mineral mixes mainly under conditions of Odessa oblast' (the experiments were conducted, in most cases with corn, as well as with tomatoes, potatoes and winter wheat). The average increase of yields from the addition of only the organic-mineral mixes comprised 12.7%, while in combination with silicate bacteria - 27.8%.

A two-fold watering with the addition of silicate bacteria (during the period of appearance of corn sprouts and 21 days later after the first watering) at the rate of 500 L/ha (hectare = 2.471 acres) was conducted at the Agrobiological Station of the Cherkassy Pedagogical Institute on the background of soil fertilization (10 tons of compost, 3 c (centner = 100 kg) of superphosphate and 0.5 c of potassium salt per 1 ha). Acceleration of growth and development of corn was noted, as well as a sharp decrease in the infection with boil smut and an increase of the yield of ears by 18.7% (Assistant Professor I. G. Firsov, 1958).

Head of the Elgavskii Variety Test Plot (Latvian SSR), L. Goriacheva (1957), introduced a mixture of the preparation of

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silicate bacteria with superphosphate into the soil (at a depth of 5-6 cm) at the time of the first top dressing of corn (variety Sterling). Increases of yield of green mass comprised: in 1956 - 10 c/ha (3.2%), and in 1957 - 49 c/ha (20.9%). In a similar experiment with corn at the Man'kovskii Variety Test Plot, in Cherkassy oblast', (see "Zashchita Rastenii ot Vreditel'ei i Bolezn'ei" no. 5, 1958, S. U. Petrukovich) the top dressing with superphosphate (3 c/ha), which was first mixed with 3 L of pure culture of silicate bacteria, did not reduce the disease-rate of plants with boll smut, entailed a noticeable increase of infection with fusariosis, bacteriosis of ears and infection with fungus Sphaerotheca Lev. No material difference was noted in the increase of grain yield in the variants of the experiment.

At the training farm of Dnepropetrovsk Agricultural Institute (Assistant professor E. V. Chemodanova and Assistant I. P. Maksimov, 1958) a top dressing of corn with organic-mineral mixture, with the addition of silicate bacteria, reduced the infection of plants with boll smut more than twice and increased the yield of ears by 4.2 c/ha (6.0%) as compared with the plot where only the organic-mineral mixture was used for the top dressing. According to the report of these same authors, on the fields of kolkhos "Imeni Suvorov", Dnepropetrovsk raion, 35.2 c/ha of corn ears were harvested from the control plot (without fertilizers), on the background of organic-mineral mixture - 44.5 c/ha, while after the introduction of the organic-mineral mixture together with silicate bacteria - 55.1 c/ha.

M. F. Mukhutdinov (1959) studied the effectiveness of bacterial preparations in their introduction with irrigation waters under tomatoes and cabbage on plots, the size of 100 sq. m, at the kolkhoz "Imeni Chapaeva", Buguruslansk raion, Orenburg oblast'. He established, as a result of three year research, that a complex bacterization with three preparations (azotobacterin, phosphobacterin and silicate bacteria) was characterized by the highest effectiveness, which was equal to full mineral fertilization in doses: 16-20 kg of nitrogen, 20-30 kg of phosphorus and 16-20 kg of potassium per 1 ha. Moreover, expenditures for the complex bacterization "is, approximately 10 times less than the corresponding expenditures in the application of mineral fertilizers".

Different results were obtained by S. U. Petrukovich (1957) with tomatoes. Moistening of sprout roots with the suspension of silicate bacteria (according to instruction of VIZR) did not reduce the infection of fruits by top ["vershinnoi"] rot. In conversion of the yield (from plots measuring 64 sq. m to 1 ha) the author mentions an increase of 5.6 c. With the described method of bacterization of tomato sprouts by a complex of three cited bacterial preparations M. F. Mukhutdinov obtained a considerable increase of yield (32.4%).

Treatment of seeds with the preparations of silicate bacteria. This method was tested in the overwhelming majority of experiments. As it was already reported by T. I. Fedotova ("Zashchita Rastenii ot Vreditel' i Boleznii", no. 3, 1957), at the sovkhos "Imeni

Stalin", Novo-Kubansk raion, Krasnodar krai, the infection of winter wheat with leaf rust was reduced by half, as a result of treatment of seeds with silicate bacteria, and the yield of grain increased by 3 c/ha. Similar data were obtained also in the experiments of V. I. Krivchenko (1957, 1958) at the cited sovkhos both on small plots, as well as on large production areas.

In the cited work of T. I. Fedotova it was also reported about the very high effectiveness of the use of silicate bacteria for the increase of disease-resistance and yielding capacity of such crops as corn, barley, rice, peas, lupines, and others. According to data of a post graduate student of VIZR, Comrade Mironenko (1953-1955), it proved to be possible almost fully to liquidate the foci of fusarium infection as a result of treatment of rice seeds at the kolkhozes of Chechen-Ingush Autonomous SSR. Moreover, the grain yields increased by 2.6-4.0 c/ha.

The Chair of Phytopathology of the Saratov Agricultural Institute (Instructor, Professor M. N. Rodigin) has conducted a series of experiments on the effectiveness of silicate bacteria at the kolkhoz "Spartak", Atkarsk raion, at the training farm No. 1 (Ternovsk raion) and at the Pugachev Variety Test Plot. According to the report of the Candidate of Agricultural Sciences, Z. I. Rumiantseva, at the kolkhoz "Spartak", in 1956, silicate bacteria have increased the yield of green mass and of corn ears by 32 c/ha. At the same time the amount of ears, attaining milk ripeness at the time of harvest, increased by 24%. [Begin p. 30]. But next year different results were obtained. Treat-

ment with silicate bacteria did not reduce the number of plants infected with wilt, red bacteriosis, boil smut and fusariosis, but was accompanied by a reduction (by 18%) of the infection of ears with alveolate bacteriosis.

It is interesting to point out, that under conditions of irrigation different varieties of corn responded differently to the preplanting treatment of seeds with silicate bacteria. Thus, in the variety VIR 42 a tendency for the reduction of infection with boil smut was noted, while in King-Cross 1, on the contrary, for an increase.

In the experiments of the post graduate student of the Chair of Phytopathology of the Moscow Agricultural Academy "Imeni K. A. Timiriazev", B. Chelo (1959), at the training farm "Dubki" (Vereisk raion, Moscow oblast') treatment of seeds of winter wheat ("Moskovskaya 2453" and wheat-couch grass hybrid 186) caused a slight reduction of infection (by 4%) with leaf rust, approximately the same as the phosphorus-potassium leaf feeding. A slight tendency (at times in the limits of a possible error) in the reduction of infection of wheat with leaf rust was noted in Albania by the same author. For different varieties, under conditions of irrigation, the treatment of seeds with preparations of silicate bacteria either did not tell on the yield of grain (variety San pastore), or caused its small (by 0.6 c/ha) reduction (variety Tevere), or gave (for the variety S. Kapelli) an insignificant increase (1.7 c/ha).

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It is pointed out in the cited report of L. Goriacheva that, as a result of treatment of seeds of winter wheat with silicate bacteria, the increases of grain yields comprised: for the variety Kursas - 9.4%, for the wheat-couch grass hybrid 186 - 6.8%.

S. U. Petrukovich tested at the Man'kovsk Variety Test Plot preparations of silicate bacteria, which were received from the Odessa Agricultural Institute and from VIZR. In the experiments with wheat ("Ukrainka USKHI") slight differences in the limits of the observations experiment's error were noted for both preparations in most, in the infection of plantings with boll smut, leaf rust and stem rust and a certain tendency to the reduction of the grain yield (by 0.2-0.3 c/ha).

A. E. Chumakov (Zashchita Rastenii ot Vreditel'ei i Boleznei", no. 2, 1958), as a result of experiments, conducted at kolkhozes of Krasnodar krai with the participation of the agrochemist, D. A. Andreeva, and phytopathologist, A. G. Zolotova, came to conclusion that "silicate bacteria did not effect a change in the infection of wheat with rust fungi". At the same time he reported that increases in yield on plots, which were seeded with bacterized seeds, were "within the limits of experimental error". Particularly, all data "do not confirm the conclusions of T. I. Fedotova about the technical and economic effectiveness of silicate bacteria for the control of rust by a method of applying them to the wheat seeds at the time of seeding".

The Krasnoufimsk State Selection Station (Sverdlovsk oblast) also did not discover any material positive effect from silicate bacteria, received from VIZR. Here A. S. Bolakova (1959), as a result of study of these bacteria on the resistance to bacteria and pests to spring wheat, barley and buckwheat (in an eight-field grass crop rotation on turf-leached out soil), came to conclusion that differences in yields of control and experimental variants "are within the limits of the experimental error". At the same time, as Bolakova reported to the editorial office, silicate bacteria did not produce any noticeable effect also on the reduction of the rate of infection with leaf rust and powdery mildew and of injury by frit-fly and Phorbia genitalis. Positive results of treatment of seeds of various crops were pointed out in several other scientific reports. Thus, in experiments of Comrade Zakharzhevskaja (Institute of Agriculture of North-East) the infection of the long staple flax with fusariosis was reduced to 7% as a result of bacterization of seeds (as compared with 19% in the control). Increase of seed yields by 16% and of straw by 9% were also noted.

Under conditions of Voronezh oblast', according to the report of Comrade Konovalova, treatment of sunflower seeds with silicate bacteria reduced in half the infection of this crop with white rot, and the yield of seeds increased by 3 c/ha (by 20% when compared with the control).

Silicate bacteria produced a positive effect on sugar beets, increasing the yield of roots by 27 c/ha in experiments of E. V. Chemodanova and I. P. Maksimov (1958).

V. I. Krivchenko (1957) mentioned reduction of infectiousness of cucumbers with ground rot from 46.6% (in the control) to 16% under the effect of silicate bacteria. But A. V. Kolesnik (1959), under conditions of a protected ground and of a well controlled regime of vegetation experiments (on local chernozem with the addition of 20% of crumbly humus ["peregnoi-sypets"]), came to conclusion, as a result of two years of research of the Chair of Agrochemistry and Protection of Plants of the Orenburg Agricultural Institute, that introduction of silicate bacteria together with cucumber seeds "did not give noticeable positive results neither in the degree of development of plants, nor in the reduction of the rate of infection with powdery mildew", the yield of cucumbers comprised only 45.5% of the control.

In the above cited report of E. V. Chemodanova and I. P. Maksimov (1958) it was mentioned (according to data of newspaper "Dnepropetrovskaya Pravda" of November 28, 1956) that at one of the kolkhozes, in Khmel'nitsk oblast', the use of silicate bacteria on 12 hectares of a potato field increased the yield of tubers almost by 50 c/ha (method of the application was not mentioned).

In 1956 Nemshaevsk Experimental Station obtained negative results in the treatment of seed potatoes with silicate bacteria. In 1957 two additional experiments were conducted: a) on the background of soil fertilization at the rate of 30 t of manure, 45 kg of nitrogen, 60 kg of phosphorus and 75 kg of potassium per 1 hectare, and b) on a manureless background. It was established, at the same time, that "bacterization of tubers on manureless back-

ground did not produce any increase of yield, but, on the contrary, it even reduced it. There was no increase of yield on the background of L.NP. The increase of yield comprised 5.6% on the background of NK". On the basis of results of these experiments, the scientific co-workers of the Station G. N. Tishchenko, A. D. Vaganova and A. M. Khoptiuk (1959) consider it impossible "to agree with the assertion of individual authors that silicate bacteria give positive results on all different soils".

Aftereffect of silicate bacteria. The attention of researchers was also attracted, among the most important questions, to the possibility of an aftereffect through seeds and planting material on plants of the following generation. According to data of T. I. Fedotova (1957) and V. I. Krivchenko (1958), seeds of wheat yield, which were harvested (under conditions of Krasnodar krai) from a field, where silicate bacteria were introduced, after having been planted, produced plants with a raised resistance to rust. T. I. Fedotova points out that the "effectiveness of this aftereffect is practically equal to the effect of bacteria in the year of application. The same was noted in respect to the yield". According to data, cited above, of the Nemshaevsk Station the treatment of seed potatoes with preparations of silicate bacteria did not entail any noticeable improvements of seeding qualities in the harvest of tubers. [Begin p.31]

Such are the more or less specific data about the effectiveness of various methods of application of silicate bacteria for the in-

crease of yielding capacity and reduction of the rate of infection with diseases of agricultural crops in a short.outline. In addition to them it is necessary to consider also the report, sent to the editorial office by the Learned Co-Worker of the All-Union Scientific-Research Institute of Microbiology, K. I. Surman (1959). It is mentioned there in a general outline that "use of silicate bacteria is not less effective than the application of the universally recognized bacterial fertilizers - azotobacterin and phosphobacterin. According to summaries of the years 1956 and 1957 among the 315 experiments with silicate bacteria an increase of yield was obtained in 265 cases".

As it is seen from the above stated, in a number of experiments on a large amount of vegetative and field plots, as well as in production tests on hundreds and thousands of hectares it was noted that introduction of silicate bacteria directly into the soil with fertilizers, with irrigating waters, with planting and seeding materials produced considerable increase of yields, and reduction of the rate of infection of agricultural crops with various fungus and bacterial diseases, and, what is still more important, a considerable increase of productivity of agricultural crops and improvement of the seeding qualities of grain yields.

From the economic point of view the high effectiveness of silicate bacteria is especially emphasized also by the insignificant cost of these preparations. It comprises no more than 20-50 kopecks (kopeck = 1/100 of a ruble) per 1 ha of planting. Besides

that, introduction of silicate bacteria with fertilizers, with irrigating waters, with seeds, and such other methods is not connected with economically appreciable additional expenditures. But mentioning these positive aspects, one cannot close the eyes on the rather considerable amount of experiments where no positive effect by silicate bacteria was noted - neither a reduction of the rate of infection with diseases, nor increase of yields and improvement of seeding qualities (of potatoes).

Naturally a question arises: what causes the contradiction in the evaluation of effectiveness of silicate bacteria? To answer this one should know the physiological-biochemical characteristics of the cited bacteria. Is it not, first of all, that the improvements, which can be introduced by silicate bacteria into the conditions of nutrition of plants under different soil-climatic and economic circumstances are determined exactly by these characteristics.

Physiological-biochemical characteristics of silicate bacteria.

A. G. Aleksandrov points out, that the improvement of nutrition of plants, produced by silicate bacteria, comes to the fact that these bacteria, breaking down the aluminum silicates of the soil, increase the supplies of assimilable potassium; they also convert into a state that is assimilable to higher plants the supplies of phosphorus, which are found in the soil, and they also assimilate the nitrogen of the air.

T. I. Fedotova (1957), V. I. Krivchenko (1957, 1958) and K. I. Surman (1959) basically confirm the mentioned role of the cited bacteria in the improvement of phosphoro-potassium nutrition. At the same time, for instance, according to data of K. I. Surman, "silicate bacteria did not produce any increase of yield with a background lacking mineral fertilizers, did not increase the yield also on the background of nitrogen and phosphorus fertilizers. Increase of yield was obtained only on the background of NK under conditions of sufficient potassium and nitrogen nutrition". Results of experiments (which are cited by this author, unfortunately, without mentioning the species of experimental plants) attest also that in the chernozem and podzol soils silicate bacteria "can improve potassium nutrition only insignificantly (by 3-6%), but can facilitate phosphorus nutrition to a more appreciable degree (up to 12-18%)".

Increase of contents of soluble compounds of nitrogen and potassium was mentioned in the experiments of A. E. Chumakov (Krasnodar krai, 1958). But, in contrast to data of K. I. Surman, changes in the contents of assimilable phosphorus were not discovered.

The plants can have all the necessary elements of nutrition in the presence of organic-mineral fertilizers. Under similar conditions, in the opinion of V. G. Aleksandrov (1958), "the usual explanation that silicate bacteria furnish potassium to the plants in the same manner as phosphorus bacteria furnish phosphorus or

azotobacteria-nitrogen, does not suit". It is proper to mention, in connection with this, that certain authoritative specialists, microbiologists, repeatedly pointed to the insufficient research in the biology of silicate bacteria. In individual statements even the existence proper of such bacteria, as a biological type, was doubted. At the same time there exist considerable practical data indicating the singularity of these bacteria, as well as about the rightfulness of their separation into an independent species.

Of fairly big importance also is the fact that such bacteria, apparently, often are contained in the soil in considerable numbers (V. A. Pisemskaja and T. A. Kochunova, 1956). Therefore, it might be wise in many cases, for the increase of effectiveness of silicate bacteria, first of all to create conditions in the soil, which would help the multiplication and strengthening of the metabolic activity of these bacteria.

Experience of many years in the studies of nitrogen-fixing and other bacteria attests also about possible great importance of comparative studies and selection of strains of bacteria, which, occasionally, possess sharply stepped up activity of one or another property. Such work, in respect to silicate bacteria, has just been started.

In this way both the physiologo-biochemical data about silicate bacteria as well as the results of field experiments of their application are far from free from contradictions. They are, in all probability, conditioned not only by the characteristics of

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strains, soil and so on, but also by differences in methods themselves of microbiological, physiological-biochemical, agrochemical and other research. Suffice it to say that, for instance, determination of the content of phosphorus in the soil decidedly depends on methods of its extraction and of quantitative analysis. But different authors used dissimilar methods in the studies of this problem, as well as in the determination of the contents of other elements of plant nutrition in connection with the application of silicate bacteria. This circumstance alone in combination with a diversity of climatic, soil and economic conditions can lead not only to contradictory, but even to mutually excluding conclusions.

Along with the cited reasons the lack of coordination in the evaluation of effectiveness of silicate bacteria is conditioned to a large degree also by defects in methods of field experiments. Quite often they were conducted without replications. Consequently, one of the basic conditions, necessary for the obtaining of reliable results, was violated. At the same time, in the greater part of experiments in their accounting and analysis proper attention was not given to the evaluation of accuracy of results and authenticity of differences in the infection with diseases and differences in yields of compared variants.

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[Begin p.32]

The cited practical data and their concise analysis indicate that the problem about silicate bacteria requires further studies.

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Discussion data, published on the pages of the journal, as well as other literary data, in conjunction with a series of other reports, enumerated above, - all this points to a possible large economic importance of silicate bacteria. But in order, finally, to decide the effectiveness of the latter, and, at a positive decision of the question - to provide in the production practice the stable effect of these bacteria on the reduction of the rate of infection, on the raising and improvement of qualities of the yields, it is necessary basically to improve a further development of this problem.

In contradistinction to separate experiments, which took place up to the present time, coordinated collective work, is needed by scientific institutions and kolkhoses and sovkholes, according to a single plan, by approved methods, in the presence of a systematic organization, methodical leadership and control. It can be the most correctly carried out by a group of qualified microbiologists, physiologists, agrochemists, soil scientists, climatologists, plant growers and phytopathologists. VASKHNIL [All-Union Academy of Agricultural Sciences imeni V. I. Lenin] can organize such a work the best of all.

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Fedorinchik, N. S.

Effektivnost' biopreparata trikhodermin-3

[The effectiveness of biopreparation Trichodermin-3]

Zashchita Rastenii, vol. 4, no. 5, p.32-33.
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(In Russian)

Microorganisms, which live by parasitizing the root systems of plants, are to a large degree inhibited by saprophyte forms even before they have time to enter the tissue of a living plant. They develop only in those cases when for some reason or other the plant root system has become impoverished in their antagonists. Therefore the isolation from different types of soils of the most hardy and often found microorganisms, which are able to dislodge and inhibit the parasitic forms, is of great theoretical and practical interest.

Enrichment of soil with saprophyte forms, antagonists, can be achieved in various ways: by planting specific plants, by special methods of soil cultivation, introduction of directed crop rotations, introduction of the culture of antagonists in one or another form, and others. Our research was directed on the enrichment of soil with the widely known fungus-antagonist, Trichoderma lignorum Harz., by means of its introduction in the form of biopreparation Trichodermin-3. This preparation represents the culture of Trichoderma, artificially cultivated and accumulated in the mass on warmed up peat. We chose peat, as substratum for the nutrition of the fungus,

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for two reasons: it is the cheapest and most readily available and itself is a good organic fertilizer. We prepared Trichodermin according to the instruction of the Laboratory of the Microbiomethod of VIZR [All-Union Institute of Plant Protection].

At Pavlovsk, on the section of the Pushkin base of VIZR, a field experiment with winter wheat "Leningradka" was conducted for the evaluation of the antagonistic activity of Trichoderma in the restriction of development of covered smut (wheat smut). Trichodermin-3 was introduced at planting of seeds into the rows at the rate of 800 ha/m². [hectare = 2.471 acres]. The same amount of heated peat was used in the control. Wheat seeds were planted without any treatment.

In the variant, where Trichodermin-3 was introduced into the soil, the yield of wheat proved to be by 26.7% higher, and there were by 29.6% less of wheat smut balls than in the control. Dusting the seeds with Trichodermin and their treatment with the suspension of the pure culture of the fungus did not produce any effect. Although Trichodermin, after being introduced into the soil, considerably limited the development of smut, the contamination of seeds with spores comprised 0.6%.

Field experiments for the evaluation of effectiveness of Trichodermin-3 in reducing the rate of infection of flax with fusariosis and black spot were conducted, approximately, according to a similar scheme. Data are cited in Table 1.

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Table 1.

Variant of the experiment	Plants per 1 m^2	Weight of a sheaf from 1 m^2 (g)	% of plants infected with black spot and fusariosis	Smut balls ["golovok"] per 100 plants
Control	342	657	15.4	479
Introduction of Trichodermin into the soil	397	1162	9.5	855
Treatment of seeds with <u>Trichoderma</u> (pure culture)	350	798	11.6	695

[Begin p.33]

Positive results were also obtained in the restriction of development of pathogens of root rot of spring wheat (table 2).

Table 2.

Variant of the experiment	Plants per 1 m^2	Stalks per 1 m^2	Weight of seeds per 1 m^2 (g)	% of infected plants
Control (pure)	187	273	38.4	4.0
Control (introduction into the soil of heated peat at the time of seeding)	196	281	55.5	0.0
Introduction into the soil of Trichodermin at the time of seeding	212	321	58.5	0.0
Treatment of seeds with pathogens of root rots of wheat (<i>Fusarium</i> and <i>Helminthosporium</i>) at seeding time	78	106	13.6	24.0
Treatment of seeds with pathogens of root rots and <u>Trichoderma</u> at seeding time	145	205	32.1	4.0

Thus, many-sided field experiments attest that Trichodermin-3 limits the development of many disease pathogens, which are transferred through the soil, and in this way produces a positive effect on the yield of agricultural plants. The norm of introduction of the preparation in the soil can be different, depending on several

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local conditions. Less of it should be introduced into the soils that are rich in organic substance, are well heated through and are normally moistened, but more of it should be introduced into impoverished, cold soils. According to our data, the most advantageous dose with peat is 8 t/ha for the north-eastern zone. The method of introduction is of no fundamental importance: into the rows or holes simultaneously with the seeding or planting. The increase of yield from the cited dose of Trichodermin-3 is greater than from 80 t/ha of peat alone.

The necessity of heating the peat for this preparation is a drawback in the technology of its obtaining. Work is conducted for the replacement of heating with composting, as well as with formalization (by L. F. Abizova, a post-graduate student).

The effectiveness of Trichodermin should be tested on a wider scale. From our point of view there exist all the grounds for its wide introduction into production.